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# STAR

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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics.*

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For related information see also *34 Fluid Mechanics and Heat Transfer.*

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## PHYSICS

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For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics.*

**71 ACOUSTICS** 776
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution.*

**72 ATOMIC AND MOLECULAR PHYSICS** 777
Includes atomic structure, electron properties, and molecular spectra.

**73 NUCLEAR AND HIGH-ENERGY PHYSICS** 779
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation.*

**74 OPTICS** 780
Includes light phenomena and optical devices.
For lasers see *36 Lasers and Masers.*

**75 PLASMA PHYSICS** 782
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics.*

**76 SOLID-STATE PHYSICS** 785
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

**77 THERMODYNAMICS AND STATISTICAL PHYSICS** 790
Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

**SOCIAL SCIENCES**

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

**80 SOCIAL SCIENCES (GENERAL)** N.A.
Includes educational matters.

**81 ADMINISTRATION AND MANAGEMENT** 790
Includes management planning and research.

**82 DOCUMENTATION AND INFORMATION SCIENCE** 791
Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.
For computer documentation see *61 Computer Programming and Software.*

**83 ECONOMICS AND COST ANALYSIS** N.A.
Includes cost effectiveness studies.

**84 LAW, POLITICAL SCIENCE AND SPACE POLICY** 792
Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

**85 URBAN TECHNOLOGY AND TRANSPORTATION** 792
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

**SPACE SCIENCES**

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

**88 SPACE SCIENCES (GENERAL)** N.A.

**89 ASTRONOMY** 800
Includes radio, gamma-ray, and infrared astronomy; and astrometry.

**90 ASTROPHYSICS** 801
Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics.*

**91 LUNAR AND PLANETARY EXPLORATION** 804
Includes planetology; and manned and unmanned flights.
For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

**92 SOLAR PHYSICS** 805
Includes solar activity, solar flares, solar radiation and sunspots.
For related information see *93 Space Radiation.*

**93 SPACE RADIATION** 806
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

**GENERAL**

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.

**99 GENERAL** N.A.

**Note: N.A. means that no abstracts were assigned to this category for this issue.**

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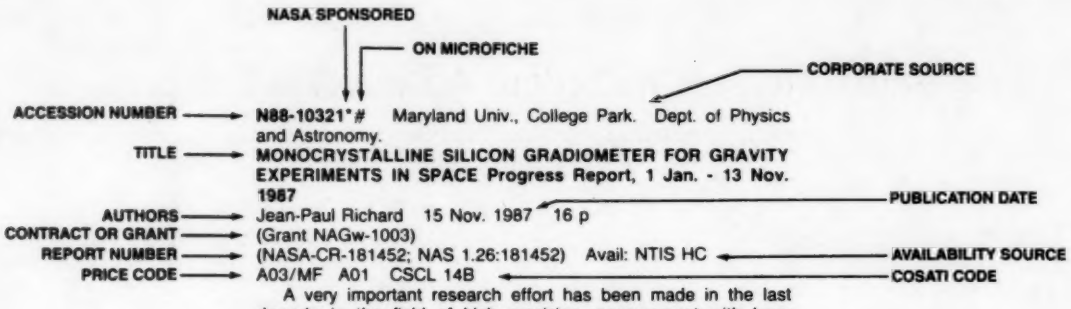
# TYPICAL CITATION AND ABSTRACT




A very important research effort has been made in the last decade in the field of high precision measurement with laser instrumentation. The development of a space borne gradiometer operating at a high sensitivity level using laser measurement of the distance between proof mass over a short base line of order one meter is discussed. Two aspects of laser technology make it a promising tool for gradiometry measurements: quantum limited accuracy and absolute distance measurements. The quantum limit associated with laser instrumentation was formulated. The relevant quantum and classical sources of errors in laser measurements were reviewed and corresponding laser performance requirements for gradient measurements were evaluated. Some mechanical quality factor measurements were made on simple resonant monocrystalline silicon suspensions. It was discovered that the use of zero derivative restoring forces to position the gradiometer test masses will dramatically reduce the gradiometer temperature control requirements. A laser beam side injection scheme was discovered which permits rejection of common mode accelerations. These concepts are briefly discussed. Author

VOLUME 26 NUMBER 6 / MARCH 23, 1988

# Scientific and Technical Aerospace Reports

*A Semimonthly Publication of the National Aeronautics and Space Administration*

## 01 AERONAUTICS (GENERAL)

**N88-14064*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**A NUMERICAL MODEL OF UNSTEADY, SUBSONIC AEROELASTIC HEHAVIOR Ph.D. Thesis - Virginia Polytechnic Inst. and State Univ.**
Thomas William Strganac Dec. 1987 121 p
(NASA-TM-100487; NAS 1.15:100487) Avail: NTIS HC A06/MF A01 CSCL 01B

A method for predicting unsteady, subsonic aeroelastic responses has been developed. The technique accounts for aerodynamic nonlinearities associated with angles of attack, vortex-dominated flow, static deformations, and unsteady behavior. The angle of attack is limited only by the occurrence of stall or vortex bursting near the wing. The fluid and the wing together are treated as a single dynamical system, and the equations of motion for the structure and the flow field are integrated simultaneously and interactively in the time domain. The method employs an iterative scheme based on a predictor-corrector technique. The aerodynamic loads are computed by the general unsteady vortex-lattice method and are determined simultaneously with the motion of the wing. Because the unsteady vortex-lattice method predicts the wake as part of the solution, the history of the motion is taken into account; hysteresis is predicted. Two models are used to demonstrate the technique: a rigid wing on an elastic support experiencing plunge and pitch about the elastic axis, and a continuous wing rigidly supported at the root chord experiencing spanwise bending and twisting. The method can be readily extended to account for structural nonlinearities and/or substitute aerodynamic load models. The time domain solution coupled with the unsteady vortex-lattice method provides the capability of graphically depicting wing and wake motion. Author

**N88-14065*** National Aeronautics and Space Administration, Washington, D.C.
**AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 220)**
Dec. 1987 167 p
(NASA-SP-7037(220); NAS 1.21:7037(220)) Avail: HC A08 CSCL 01A

This bibliography lists 596 reports, articles, and other documents introduced into the NASA scientific and technical information system in November, 1987. Author

**N88-14066*#** Lockheed-Georgia Co., Marietta.
**STRUCTURAL TESTS AND DEVELOPMENT OF A LAMINAR FLOW CONTROL WING SURFACE COMPOSITE CHORDWISE JOINT Final Report**
L. B. Lineberger Dec. 1984 197 p
(Contract NAS1-17487)
(NASA-CR-172462; NAS 1.26:172462; LG84ER0113) Avail: NTIS HC A09/MF A01 CSCL 01A

The dramatic increases in fuel costs and the potential for periods of limited fuel availability provided the impetus to explore technologies to reduce transport aircraft fuel consumption. NASA sponsored the Aircraft Energy Efficiency (ACEE) program beginning in 1976 to develop technologies to improve fuel efficiency. The Lockheed-Georgia Company accomplished under NAS1-16235 Laminar-Flow-Control (LFC) Wing Panel Structural Design and Development (WSSD); design, manufacturing, and testing activities. An in-depth preliminary design of the baseline 1993 LFC wing was accomplished. A surface panel using the Lockheed graphite/epoxy integrated LFC wing box structural concept was designed. The concept was shown by analysis to be structurally efficient and cost effective. Critical details of the surface and surface joint was demonstrated by fabricating and testing complex, concept selection specimens. The Lockheed-Georgia Company accomplishments, Development of LFC Wind Surface Composite Structures (WSCS), are documented. Tests were conducted on two CV2 panels to verify the static tension and fatigue strength of LFC wing surface chordwise joints. Author

## 02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

**N88-14067*#** Honeywell, Inc., Clearwater, Fla. Space and Strategic Avionics Div.
**APPROACHES AND POSSIBLE IMPROVEMENTS IN THE AREA OF MULTIBODY DYNAMICS MODELING**
K. W. Lips and R. Singh (DYNACS Engineering Co., Inc., Clearwater, Fla.) 30 Oct. 1987 45 p
(Contract NAS8-34588)
(NASA-CR-179227; NAS 1.26:179227) Avail: NTIS HC A03/MF A01 CSCL 01A

A wide ranging look is taken at issues involved in the dynamic modeling of complex, multibodied orbiting space systems. Capabilities and limitations of two major codes (DISCOS, TREETOPS) are assessed and possible extensions to the CONTOPS software are outlined. In addition, recommendations are made concerning the direction future development should take in order to achieve higher fidelity, more computationally efficient multibody software solutions. Author

**N88-14068*#** Northrop Corp., Hawthorne, Calif. Aircraft Div.
**INTEGRATION OF A SUPERSONIC UNSTEADY AERODYNAMIC CODE INTO THE NASA FASTEX SYSTEM Final Report**
Kari Appa and Michael J. C. Smith Dec. 1987 42 p
(Contract NAS2-12597)
(NASA-CR-182329; NAS 1.26:182329) Avail: NTIS HC A03/MF A01 CSCL 01A

A supersonic unsteady aerodynamic loads prediction method based on the constant pressure method was integrated into the NASA FASTEX system. The updated FASTEX code can be employed for aeroelastic analyses in subsonic and supersonic flow regimes. A brief description of the supersonic constant pressure panel method, as applied to lifting surfaces and body configurations, is followed by a documentation of updates required to incorporate this method in the FASTEX code. Test cases showing correlations of predicted pressure distributions, flutter solutions, and stability derivatives with available data are reported. Author

**N88-14069#** Sandia National Labs., Albuquerque, N. Mex.
**DUCTED PROPELLER DESIGN AND ANALYSIS**
R. J. Weir Oct. 1987 60 p
(Contract DE-AC04-76DP-00789)
(DE88-001925; SAND-87-2118) Avail: NTIS HC A04/MF A01

The theory and implementation of the design of a ducted propeller blade are presented and discussed. Straightener (anti-torque) vane design is also discussed. Comparisons are made to an existing propeller design and the results and performance of two example propeller blades are given. The inflow velocity at the propeller plane is given special attention and two dimensionless parameters independent of RPM are discussed. Errors in off-design performance are also investigated. DOE

**N88-14070*#** Texas Univ., Austin. Dept. of Mechanical Engineering.
**POTENTIAL FLOW AROUND TWO-DIMENSIONAL AIRFOILS USING A SINGULAR INTEGRAL METHOD Final Report**
Yves Nguyen and Dennis Wilson Dec. 1987 129 p
(Grant NAG1-556)
(NASA-CR-182345; NAS 1.26:182345; Rept-87-104) Avail: NTIS HC A07/MF A01 CSCL 01A

The problem of potential flow around two-dimensional airfoils is solved by using a new singular integral method. The potential flow equations for incompressible potential flow are written in a singular integral equation. The equation is solved at N collocation points on the airfoil surface. A unique feature of this method is that the airfoil geometry is specified as an independent variable in the exact integral equation. Compared to other numerical methods, the present calculation procedure is much simpler and gives remarkable accuracy for many body shapes. An advantage of the present method is that it allows the inverse design calculation and the results are extremely accurate. Author

**N88-14071*** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**COMBINED RIBLET AND LEBU DRAG REDUCTION SYSTEM Patent**
Michael J. Walsh, inventor (to NASA), John B. Anders, inventor (to NASA), and Jerry N. Hefner, inventor (to NASA) 17 Nov. 1987 10 p Filed 27 Dec. 1984 Supersedes N85-28922 (23 - 18, p 3058)
(NASA-Case-LAR-13286-1; US-Patent-4,706,910; US-Patent-Appl-SN-686959; US-Patent-Class-244-130; US-Patent-Class-244-200; US-Patent-Class-244-199; US-Patent-Class-114-67R; US-Patent-Class-296-1S; US-Patent-Class-138-38) Avail: US Patent and Trademark Office CSCL 01A

The invention is a system of flow control devices which result in reduced skin friction on aerodynamic and hydrodynamic surfaces. The devices cause a breakup of large-scale disturbances in the boundary layer of the flow field. The riblet device acts to reduce disturbances near the boundary layer wall by the use of longitudinal striations forming V-shaped grooves. These grooves are dimensional on the order of the wall vortices and turbulent burst dimensions. The large eddy breakup device is a small strip or airfoil which is suspended in the upper region of the boundary layer. Various physical mechanisms cause a disruption of the large-scale vortices. The combination of the devices of this invention result in a substantial reduction in skin friction drag.
Official Gazette of the U.S. Patent and Trademark Office

**N88-14072** Stanford Univ., Calif.
**STUDIES OF SUPERSONIC TURBULENCE AND HOT-WIRE RESPONSE USING LASER-INDUCED FLUORESCENCE (LIF) Ph.D. Thesis**
Pamela Logan [1987] 169 p
Avail: Univ. Microfilms Order No. DA8720414

Recently, a laser-induced fluorescence (LIF) technique for measuring temperture, density, and pressure in turbulent flow was developed. Measurements of the correlations of certain flow variables, which are of great importance to turbulence modeling, are now possible with LIF. The LIF measurements can be used to clarify the behavior of a hot-wire anemometer in compressible flow, thereby enabling researchers to use it with more confidence. The flow selected for the first use of LIF was a flat-plate boundary layer embedded in a uniform stream of Mach number 2. A hot-wire calibration procedure was developed, as well as a hot-wire data reduction method. The LIF and hot-wire measurements were compared and combined in various fashions. Measurements of fluctuating mass flux, temperature, density, pressure, streamwise velocity, and other variables were obtained, as well as numerous correlations. In general, the flow variables were found to be, more often than not, moderately or highly correlated with one another; therefore modelers should use caution in discarding correlation terms from the equations of motion. The measurements provide insight into the ways that the three modes of compressible turbulence (vorticity, entropy, and sound) behave in a real flow.
Dissert. Abstr.

**N88-14073** Stanford Univ., Calif.
**TRANSONIC NAVIER-STOKES COMPUTATIONS OF STRAKE-GENERATED VORTEX INTERACTIONS FOR A FIGHTER-LIKE CONFIGURATION Ph.D. Thesis**
Steven Gerard Resnick [1987] 174 p
Avail: Univ. Microfilms Order No. DA8720426

Transonic Euler/Navier-Stokes computations are accomplished for wing-body flow fields using a computer program called Transonic Navier-Stokes (TNS). The wing-body grids are generated using a program called ZONER, which subdivides a coarse grid about a fighter-like aircraft configuration into smaller zones, which are tailored to local grid requirements. These zones can be either finely clustered for capture of viscous effects, or coarsely clustered for inviscid portions of the flow field. Different equation sets may be solved in the different zone types. This modular approach also affords the opportunity to modify a local region of the grid without recomputing the global grid. This capability speeds up the design optimization process when quick modifications to the geometry definition are desired. The solution algorithm embodied in TNS is implicit, and is capable of capturing pressure gradients associated with shocks. The algebraic turbulence model employed has proven adequate for viscous interactions with moderate separation. Boundary conditions are treated explicitly with some necessary restrictions on the solution domain. Proof of concept was demonstrated with solutions for a General Dynamics F-16A-like configuration. The results confirm that the TNS program can successfully be used to simulate transonic viscous flows about complicated three-dimensional geometries. Dissert. Abstr.

**N88-14074** Old Dominion Univ., Norfolk, Va.
**INVESTIGATION OF VISCOUS/INVISCID INTERACTION IN TRANSONIC FLOW OVER AIRFOILS WITH SUCTION Ph.D. Thesis**
Chandra Sekhar Vemuru 1986 126 p
Avail: Univ. Microfilms Order No. DA8719143

The viscous/inviscid interaction over transonic airfoils with and without suction is studied. The streamline angle at the edge of the boundary layer is used to couple the viscous and inviscid flow field. In the shock region the Euler equations are solved using the method of integral relations. For this the potential flow solution is used as the initial and boundary conditions. An integral method is used to solve the laminar boundary layer equations. Since both methods are integral methods, a continuous interaction is allowed between the outer inviscid flow region and the inner viscous flow region. The results are found to be in good agreement with experimental data and with the results of other computational methods. Dissert. Abstr.

**N88-14075*#** Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
**DEVELOPMENT OF AN UNSTEADY WAKE THEORY APPROPRIATE FOR AEROELASTIC ANALYSES OF ROTORS IN HOVER AND FORWARD FLIGHT Semiannual Status Report No. 1, 1 Jul. - 31 Dec. 1987**
David A. Peters 4 Jan. 1988 32 p
(Grant NAG2-462)

(NASA-CR-182357; NAS 1.26:182357) Avail: NTIS HC A03/MF A01 CSCL 01A

The purpose of this research is the development of an unsteady aerodynamic model for rotors such that it can be used in conventional aeroelastic analysis (e.g., eigenvalue determination and control system design). For this to happen, the model must be in a state-space formulation such that the states of the flow can be defined, calculated and identified as part of the analysis. The fluid mechanics of the problem is given by a closed-form inversion of an acceleration potential. The result is a set of first-order differential equations in time for the unknown flow coefficients. These equations are hierarchical in the sense that they may be truncated at any number of radial or azimuthal terms. Author

**N88-14076#** Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

**THE AERODYNAMIC DESIGN OF HYPERSONIC CONTOURED AXISYMMETRIC NOZZLES INCLUDING REAL GAS EFFECTS**

G. Simeonides Mar. 1987 70 p

(VKI-TM-43; ETN-88-90727) Avail: NTIS HC A04/MF A01

An aerodynamic design procedure for contoured nozzles to replace the conical nozzles of a hypersonic wind tunnel is presented. The facility produces high Reynolds/high Mach number flows, for the simulation of reentry vehicle flight. The design is accomplished by calculating an inviscid contour and adding a boundary layer correction to it. The inviscid contour is obtained by the method of characteristics, given a predetermined velocity/Mach number distribution along prescribed boundaries after Sivells (1970). Boundary layer thickness and displacement thickness are calculated from Edenfield's empirical correlations, which, considering the exceptional operating conditions are as satisfactory as sophisticated boundary layer methods. The calculation procedure and the associated computer programs are given. ESA

**N88-14077#** Technische Hogeschool, Delft (Netherlands). Inst. for Wind Energy.

**PERFORMANCE MEASUREMENTS OF THE KOLIBRIE AND FACT ROTOR BLADES WITHOUT TIP VANES ON THE FULL-SCALE EXPERIMENTAL WIND TURBINE**

A. Bruining Apr. 1987 50 p Prepared for the Magagement Office for Energy Research Sponsored by the Ministry of Economic Affairs

(IW-R518; ETN-88-91343) Avail: NTIS HC A03/MF A01

The drag of the rotor hub sections alone without blades, blade drag, and the performance the Kolibrie and FACT rotors were measured. There were no tip vanes mounted. The hub section of the Kolibrie rotor gives a rather high drag. The drag level of the hub section of the FACT rotor is half that of the hub section of the Kolibrie rotor. The blade drag measurements are presented in plots which give the average blade drag coefficient as a function of the tip-speed ratio (TPR). The blade drag coefficient of the FACT rotor is also half that of the Kolibrie rotor. The results of the performance measurements for blade tip pitch angles between -1.5 and +3 deg are given in Cp-TPR plots. The covered TPR are between 5 and 15. The measured Cp of the FACT rotor is a little lower than expected. ESA

**N88-14078*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**WIND TUNNEL RESULTS FOR A HIGH-SPEED, NATURAL LAMINAR-FLOW AIRFOIL DESIGNED FOR GENERAL AVIATION AIRCRAFT**

William G. Sewall, Robert J. McGhee, Jeffery K. Viken, Edgar G. Waggoner, Betty S. Walker, and Betty F. Millard Nov. 1985 73 p

(NASA-TM-87602; NAS 1.15:87602) Avail: NTIS HC A04/MF A01 CSCL 01A

Two dimensional wind tunnel tests were conducted on a high speed natural laminar flow airfoil in both the Langley 6 x 28 inch Transonic Tunnel and the Langley Low Turbulence Pressure Tunnel. The test conditions consisted of Mach numbers ranging from 0.10 to 0.77 and Reynolds numbers ranging from 3 x 1 million to 11 x 1 million. The airfoil was designed for a lift coefficient of 0.20 at a Mach number of 0.70 and Reynolds number of 11 x 1 million. At these conditions, laminar flow would extend back to 50 percent chord of the upper surface and 70 percent chord of the lower surface. Low speed results were also obtained with a 0.20 chord trailing edge split flap deflected 60 deg. Author

**N88-14079*#** Rockwell International Corp., Los Angeles, Calif. North American Aircraft Operations.

**NONLINEAR AERODYNAMIC WING DESIGN Final Report**

Ellwood Bonner Washington NASA Dec. 1985 78 p

(Contract NAS1-15820)

(NASA-CR-3950; NAS 1.26:3950) Avail: NTIS HC A05/MF A01 CSCL 01A

The applicability of new nonlinear theoretical techniques is demonstrated for supersonic wing design. The new technology was utilized to define outboard panels for an existing advanced tactical fighter model. Mach 1.6 maneuver point design and multi-operating point compromise surfaces were developed and tested. High aerodynamic efficiency was achieved at the design conditions. A corollary result was that only modest supersonic penalties were incurred to meet multiple aerodynamic requirements. The nonlinear potential analysis of a practical configuration arrangement correlated well with experimental data. Author

**N88-14080#** Yale Univ., New Haven, Conn.

**TURBULENCE, TURBULENCE CONTROL, AND DRAG REDUCTION Final Technical Report, Aug. 1982 - Aug. 1985**

K. R. Sreenivasan 1 Aug. 1987 101 p

(Grant AF-AFOSR-0299-82)

(AD-A185643; AFOSR-87-0984TR) Avail: NTIS HC A06/MF A01 CSCL 20D

Progress is reported on fundamental studies in turbulence dynamics, flow control, and drag reduction. The following topics are discussed: on anologies between turbulence in unconfined flows and chaotic dynamical systems; transition and turbulence in fluid flows, and low-dimensional chaos; chaos in open flow systems; the fractal facets of turbulence; transition intermittency in open flows, and intermittency routes to chaos; an instability associated with a sudden expansion in a pipe flow; and on the scaling of the turbulence energy dissipation rate. GRA

**N88-14081#** Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Turbomachinery and Propulsion Research.

**POST STALL BEHAVIOR IN AXIAL-FLOW COMPRESSORS Final Report, Mar. 1983 - Jan. 1987**

Walter F. OBrien 20 Aug. 1987 67 p

(Contract F49620-83-K-0024)

(AD-A185712; WFOB/87-0801; AFOSR-87-1195TR) Avail: NTIS HC A04/MF A01 CSCL 20D

A multi-element research program was conducted to improve understanding of the role of cascade losses in compressor post-stall behavior. Experiments in a special wind tunnel designed for high-angle-of-attack investigations included surface and smoke flow visualizations and hot film anemometer velocity measurements. Results showed the details of the stall development in a cascade, and the effect of stagger on measured flow losses. Predictions of a Navier-Stokes model for separated cascade flows were compared with experimental results. An improved compressor stage model predicts post-stall characteristics, and illustrates the application of the results to compression system analysis. GRA

**N88-14082#** Case Western Reserve Univ., Cleveland, Ohio. Dept. of Mechanical and Aerospace Engineering.

**TIME-DEPENDENT HYPERSONIC VISCOUS INTERACTIONS Final Report, Mar. 1981 - Aug. 1984**

Eli Reshotko Jun. 1987 8 p

(Grant AF-AFOSR-0150-81)

(AD-A185764; AFOSR-87-1473TR) Avail: NTIS HC A02/MF A01 CSCL 20D

The effects of a wavy wall boundary on the stability of a laminar boundary layer was studied analytically. It was found that

Tollmein-Schlichting waves are not excited by the wavy boundary. Only standing waves are produced. A generalization of non-parallel stability formulations was developed for application to any two-dimensional free shear layer. GRA

**N88-14139#** Joint Publications Research Service, Arlington, Va.
**DEVELOPMENT OF TRANSONIC SPEED CASCADE DESIGN METHOD USING EULER CODE AND INVERSE SOLUTION**
Naoki Yokose *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 65-71 Transl. into ENGLISH from Kogiken Nyusu (Tokyo, Japan), May 1987 p 12-14 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

**N88-14371#** Pratt and Whitney Aircraft of Canada Ltd., Longueuil (Quebec).
**AERODYNAMIC TESTING OF SMALL TURBINES**
U. Okapuu *In* Von Karman Inst. for Fluid Dynamics, Small High Pressure Ratio Turbines 1987 20 p (For primary document see N88-14364 06-37)
Avail: NTIS HC A17/MF A01

# 03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

**N88-14083*** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**LIGHTNING DISCHARGE PROTECTION ROD Patent**
Charles F. Bryan, Jr., inventor (to NASA) 6 Oct. 1987 7 p Filed 24 Apr. 1986 Supersedes N86-26296 (24 - 17, p 2686)
(NASA-Case-LAR-13470-1; US-Patent-4,698,723; US-Patent-Appl-SN-855983; US-Patent-Class-361-218; US-Patent-Class-361-222) Avail: US Patent and Trademark Office CSCL 01C

A system for protecting an in-air vehicle from damage due to a lighning strike is disclosed. It is an extremely simple device consisting of a sacrificial graphite composite rod, approximately the diameter of a pencil with a length of about five inches. The sacrificial rod is constructed with the graphite fibers running axially within the rod in a manner that best provides a path of conduction axially from the trailing edge of an aircraft to the trailing end of the rod. The sacrificial rod is inserted into an attachment hole machined into trailing edges of aircraft flight surfaces, such as a vertical fin cap and attached with adhesive in a manner not prohibiting the conduction path between the rod and the aircraft. The trailing end of the rod may be tapered for aerodynamic and esthetic requirements. This rod is sacrificial but has the capability to sustain several lightning strikes and still provide protection.
Official Gazette of the U.S. Patent and Trademark Office

**N88-14084#** Centre d'Essais Aeronautique Toulouse (France). Lab. de Chimie Inflammabilite.
**FLAMMABILITY TEST ON AIRCRAFT SEATS EQUIPPED WITH FIRE BARRIER FABRICS FOR THE PORCHER COMPANY Test Report [ESSAIS D'INFLAMMABILITE SUR SIEGES D'AVION AVEC TISSUS BARRIER FEU POUR LA SOCIETE PORCHER]**
10 Jun. 1985 8 p In FRENCH
(CEAT-M5-525200; ETN-88-91137) Avail: NTIS HC A02/MF A01

A Kevlar fabric used to protect aircraft seats was tested for flammability. The results are satisfactory. ESA

**N88-14085#** Centre d'Essais Aeronautique Toulouse (France). Lab. de Chimie Inflammabilite.
**FLAMMABILITY, SMOKE AND TOXICITY TEST ON FIRE BARRIER FABRIC FROM THE PORCHER COMPANY Test Report [ESSAI D'INFLAMMABILITE FUMEE-TOXICITE SUR TISSU BARRIER FEU DE LA SOCIETE PORCHER]**
30 Jun. 1985 5 p In FRENCH
(ETN-88-91168; M5-515108) Avail: NTIS HC A02/MF A01

The results of safety tests on Kevlar fabric for the inside of passenger aircraft are presented. ESA

**N88-14086#** National Transportation Safety Board, Washington, D. C.
**AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, US CIVIL AND FOREIGN AVIATION, ISSUE NUMBER 4 OF 1986 ACCIDENTS**
30 Jun. 1987 392 p
(PB87-916906; NTSB/AAB-87/06) Avail: NTIS HC A17/MF A01 CSCL 01C

Selected aircraft accident reports in brief format occurring in U.S. civil and foreign aviation operations during 1986 are given. Approximately 200 general aviation and air carrier accidents represent a random selection. The facts, conditions, circumstances and probable causes are given. Author

**N88-14087#** National Transportation Safety Board, Washington, D. C. Bureau of Accident Investigation.
**AIRCRAFT ACCIDENT REPORT: GRAND CANYON AIRLINES, INC., AND HELITECH, INC., MIDAIR COLLISION OVER GRAND CANYON NATIONAL PARK, JUNE 18, 1986**
24 Jul. 1987 68 p
(PB87-910403; NTSB/AAR-87/03) Avail: NTIS HC A04/MF A01 CSCL 01C

The National Transportation Safety Board determines that the probable cause of the accident was the failure of the flightcrews of both aircraft to see and avoid each other for undetermined reasons. Contributing to the accident was the failure of the Federal Aviation Administration to exercise its oversight responsibility over flight operations in the Grand Canyon airspace and the actions of the National Park Service to influence the selection of routes by the Canyon scenic tour operators. Also contributing to the accident was the modification and configuration of the routes of the rotary wing operators resulting in their intersecting with the routes of Grand Canyon Airlines near Crystal Rapids. Author

**N88-14088*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**PROPULSION-INDUCED EFFECTS CAUSED BY OUT-OF-GROUND EFFECTS**
Richard Margason Nov. 1987 30 p
(NASA-TM-100032; A-87359; NAS 1.15:100032) Avail: NTIS HC A03/MF A01 CSCL 01C

Propulsion induced effects encountered by moderate- to high-disk loading STOVL or VSTOL aircraft out-of-ground effect during hover and transition between hover and wing-borne flight are discussed. Descriptions of the fluid flow phenomena are presented along with an indication of the trends obtained from experimental investigations. In particular, three problem areas are reviewed: (1) the performance losses sustained by a VSTOL aircraft hovering out-of-ground effect, (2) the induced aerodynamic effects encountered as a VSTOL aircraft flies on the combination of powered and aerodynamic lifts between hover and cruise out-of-ground effect, and (3) the aerodynamic characteristics caused by deflected thrust during maneuvering flight over a wide range of both angle of attack and Mach number. Author

# 04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *Communications and Radar.*

**N88-14089*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**A FULLY REDUNDANT DOUBLE DIFFERENCE ALGORITHM FOR OBTAINING MINIMUM VARIANCE ESTIMATES FROM GPS OBSERVATIONS**
William G. Melbourne 15 Dec. 1986 43 p
(Contract NAS7-918)
(NASA-CR-182363; JPL-Pub-86-30; NAS 1.26:182363) Avail: NTIS HC A03/MF A01 CSCL 17G

In double differencing a regression system obtained from concurrent Global Positioning System (GPS) observation sequences, one either undersamples the system to avoid introducing colored measurement statistics, or one fully samples the system incurring the resulting non-diagonal covariance matrix for the differenced measurement errors. A suboptimal estimation result will be obtained in the undersampling case and will also be obtained in the fully sampled case unless the color noise statistics are taken into account. The latter approach requires a least squares weighting matrix derived from inversion of a non-diagonal covariance matrix for the differenced measurement errors instead of inversion of the customary diagonal one associated with white noise processes. Presented is the so-called fully redundant double differencing algorithm for generating a weighted double differenced regression system that yields equivalent estimation results, but features for certain cases a diagonal weighting matrix even though the differenced measurement error statistics are highly colored.
Author

**N88-14090#** Federal Aviation Administration, Atlantic City, N.J.
**BOEING 727 MLS (MICROWAVE LANDING SYSTEM) TERMINAL INSTRUMENT PROCEDURES (TERPS) APPROACH DATA COLLECTION AND PROCESSING, DATA REPORT Technical Note, Feb. 1986 - Jan. 1987**
Edward J. Pugacz May 1987 14 p
(AD-A185523; DOT/FAA/CT-TN87/9) Avail: NTIS HC A03/MF A01 CSCL 17G

This is one part of the Fixed Wing Microwave Landing System (MLS) terminal instrument procedures (TERPS) data collection and processing program being performed at the Federal Aviation Administration (FAA) Technical Center. The program was undertaken to collect flight test data in various aircraft to establish a data base for development of MLS TERPS criteria. Data were collected during both missed approaches and landings using glides lopes of 3 deg, CAT II, 3.5 deg, and 4 deg with all flights being tracked by ground based tracking systems. Statistical processing was performed on both the airborne and tracker data, and various graphical plots were produced. The processed data were delivered to AVN-210 for inclusion in the MLS TERPS criterita development data base.
GRA

# 05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.* For land transportation vehicles see *85 Urban Technology and Transportation.*

**N88-14091#** National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
**DAMAGE TOLERANCE OF STIFFENED-SKIN STRUCTURES: PREDICTION AND EXPERIMENTAL VERIFICATION**
H. Vlieger 2 Jun. 1986 87 p Presented at the 19th National Symposium on Fracture Mechanics, San Antonio, Tex., 30 Jun. - 2 Jul. 1986
(Contracts NIVR-1904; NIVR-1823)
(NLR-MP-86041-U; B8707397; ETN-88-91328) Avail: NTIS HC A05/MF A01

Consequences of application of damage tolerance airworthiness requirements for transport aircraft in designing stiffened-skin structures to be safe under all operational load conditions are discussed. Computer programs to provide analytical tools to demonstrate that design meets the required residual strength and crack propagation properties were developed. The principles underlying the calculation procedures used to predict the residual strength of stiffened panels with a skin of ductile material (like 2024) are included. Applications of the programs to practical stiffened skin structures are presented together with analysis test correlations.
ESA

**N88-14092*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**AERODYNAMIC AND PROPELLER PERFORMANCE CHARACTERISTICS OF A PROPFAN-POWERED, SEMISPAN MODEL**
Alan D. Levin, Ronald C. Smith, and Richard D. Wood Dec. 1985 149 p
(NASA-TM-86705; A-85175; NAS 1.15:86705) Avail: NTIS HC A07/MF A01 CSCL 01C

A semispan wing/body model with a powered propeller was tested to provide data on a total powerplant installation drag penalty of advanced propfan-powered aircraft. The test objectives were to determine the total power plant installation drag penalty on a representative propfan aircraft; to study the effect of configuration modifications on the installed powerplant drag; and to determine performance characteristics of an advanced design propeller which was mounted on a representative nacelle in the presence of a wing.
Author

# 06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

# 07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

**N88-14093*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**NASA SUPERSONIC STOVL PROPULSION TECHNOLOGY PROGRAM**
Peter G. Batterton and Bernard J. Blaha 1987 20 p Presented at the International Powered Lift Conference, Santa Clara, Calif., 7-10 Dec. 1987; sponsored by the Society of Automotive Engineers
(NASA-TM-100227; E-3846; NAS 1.15:100227) Avail: NTIS HC A03/MF A01 CSCL 21E

Supersonic capable STOVL fighter/attack aircraft can provide capabilities for close support and air superiority which will be highly desirable in the future. Previous papers in this session described the historical aspects, trade-offs, and requirements for powered lift propulsion systems, and it is shown that propulsion technology is more key to the success of this type of aircraft then for any previous fighter/attack aircraft. The NASA Lewis Research Center program activities which address required propulsion technology development are discussed. Several elements of this program were initiated which address hot gas ingestion and ejector augmenter performance and some preliminary results are shown. In addition, some additional near-term research activity plans and the new Powered Lift Facility (PLF) research capability are presented. Author

**N88-14094*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**NUMERICAL STUDY OF CHEMICALLY REACTING FLOWS USING AN LU SCHEME Final Contractor Report**
Jian Shun Shuen (Sverdrup Technology, Inc., Cleveland, Ohio.) and Seokkwan Yoon [1988] 23 p Presented at the 26th Aerospace Sciences Meeting, Reno, Nev., 11-14 Jan. 1988; sponsored by AIAA
(Contract NAS3-24105)
(NASA-TM-180882; E-3875; NAS 1.26:180882; AIAA-88-0436) Avail: NTIS HC A03/MF A01 CSCL 21E

A new computational fluid dynamic code has been developed for the study of mixing and chemical reactions in the flow fields of ramjets and scramjets. The code employs an implicit finite volume, lower-upper symmetric successive overrelaxation scheme for solving the complete two-dimensional Navier-Stokes equations and species transport equations in a fully-coupled and very efficient manner. The combustion processes are modeled by an 8-species, 14-step finite rate chemistry model whereas turbulence is simulated by a Baldwin-Lomax algebraic model. The validity of the code is demonstrated by comparing the numerical calculations with both experimental data and previous calculations of a cold flow helium injection into a straight channel and premixed hydrogen-air reacting flows in a ramped duct. The code is then used to calculate the mixing and chemical reactions of a hydrogen jet transversely injected into a supersonic airstream. Results are presented describing the flow field, the recirculation regions in front and behind the injector, and the chemical reactions. Author

**N88-14095*#** Hamilton Standard, Windsor Locks, Conn.
**ANALYSIS AND TEST EVALUATION OF THE DYNAMIC STABILITY OF THREE ADVANCED TURBOPROP MODELS AT ZERO FORWARD SPEED Final Report**
Arthur F. Smith Dec. 1985 115 p
(Contract NAS3-22755)
(NASA-CR-175025; NAS 1.26:175025; HSER-11054) Avail: NTIS HC A06/MF A01 CSCL 01A

Results of static stability wind tunnel tests of three 62.2 cm (24.5 in) diameter models of the Prop-Fan are presented. Measurements of blade stresses were made with the Prop-Fans mounted on an isolated nacelle in an open 5.5 m (18 ft) wind tunnel test section with no tunnel flow. The tests were conducted in the United Technology Research Center Large Subsonic Wind Tunnel. Stall flutter was determined by regions of high stress, which were compared with predictions of boundaries of zero total viscous damping. The structural analysis used beam methods for the model with straight blades and finite element methods for the models with swept blades. Increasing blade sweep tends to suppress stall flutter. Comparisons with similar test data acquired at NASA/Lewis are good. Correlations between measured and predicted critical speeds for all the models are good. The trend of increased stability with increased blade sweep is well predicted. Calculated flutter boundaries generaly coincide with tested boundaries. Stall flutter is predicted to occur in the third (torsion) mode. The straight blade test shows third mode response, while the swept blades respond in other modes. Author

**N88-14096*#** Hamilton Standard, Windsor Locks, Conn.
**ANALYSIS AND TEST EVALUATION OF THE DYNAMIC RESPONSE AND STABILITY OF THREE ADVANCED TURBOPROP MODELS AT LOW FORWARD SPEED Final Report**
Arthur F. Smith Dec. 1985 110 p
(Contract NAS3-22755)
(NASA-CR-175026; NAS 1.26:175026; HSER-11055) Avail: NTIS HC A06/MF A01 CSCL 01A

Results of wind tunnel tests at low forward speed for blade dynamic response and stability of three 62.2 cm (24.5 in) diameter models of the Prop-Fan, advanced turboprop, are presented. Measurements of dynamic response were made with the rotors mounted on an isolated nacelle, with varying tilt for nonuniform inflow. Low speed stall flutter tests were conducted at Mach numbers from 0.0 to 0.35. Measurements are compared to Eigen-solution flutter boundaries. Calculated 1P stress response agrees favorably with experiment. Predicted stall flutter boundaries correlate well with measured high stress regions. Stall flutter is significantly reduced by increased blade sweep. Susceptibility to stall flutter decreases rapidly with forward speed. Author

**N88-14097*#** Hamilton Standard, Windsor Locks, Conn.
**LARGE-SCALE ADVANCED PROP-FAN (LAP) BLADE DESIGN Contractor Report, Sep. 1983 - Mar. 1984**
John A. Violette, William E. Sullivan, and Jay E. Turnberg 1984 181 p
(Contract NAS3-23051)
(NASA-CR-174790; NAS 1.26:174790; HSER-9246) Avail: NTIS HC A09/MF A01 CSCL 01C

This report covers the design analysis of a very thin, highly swept, propeller blade to be used in the Large-Scale Advanced Prop-Fan (LAP) test program. The report includes: design requirements and goals, a description of the blade configuration which meets requirements, a description of the analytical methods utilized/developed to demonstrate compliance with the requirements, and the results of these analyses. The methods described include: finite element modeling, predicted aerodynamic loads and their application to the blade, steady state and vibratory response analyses, blade resonant frequencies and mode shapes, bird impact analysis, and predictions of stalled and unstalled flutter phenomena. Summarized results include deflections, retention loads, stress/strength comparisons, foreign object damage resistance, resonant frequencies and critical speed margins, resonant vibratory mode shapes, calculated boundaries of stalled and unstalled flutter, and aerodynamic and acoustic performance calculations. Author

**N88-14370#** Pratt and Whitney Aircraft of Canada Ltd., Longueuil (Quebec).
**AERODYNAMIC DESIGN OF FIRST STAGE TURBINES FOR SMALL AERO ENGINES**
U. Okapuu *In* Von Karman Inst. for Fluid Dynamics, Small High

Pressure Ratio Turbines 1987 32 p (For primary document see N88-14364 06-37)
Avail: NTIS HC A17/MF A01

# 08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

For related information see also *05 Aircraft Design, Testing and Performance.*

**N88-14098*** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**A GENERALIZATION OF A TECHNIQUE FOR ESTIMATING NOISE COVARIANCES IN A LINEAR SYSTEM USING MULTIPLE OBSERVERS**
W. Thomas Bundick Feb. 1988 33 p
(NASA-TM-4020; L-16349; NAS 1.15:4020) Avail: NTIS HC A03/MF A01 CSCL 01C

Friedland's technique for estimating the unknown noise variances of a linear system using multiple observers has been extended by developing a general solution for the estimates of the variances, developing the statistics (mean and standard deviation) of these estimates, and demonstrating the solution on two examples. Author

**N88-14099*#** Purdue Univ., West Lafayette, Ind. School of Aeronautics and Astronautics.
**A SIMULATION STUDY OF THE FLIGHT DYNAMICS OF ELASTIC AIRCRAFT. VOLUME 1: EXPERIMENT, RESULTS AND ANALYSIS Final Report**
Martin R. Waszak, John B. Davidson, and David K. Schmidt Washington NASA Dec. 1987 122 p
(Grant NAG1-254)
(NASA-CR-4102; NAS 1.26:4102) Avail: NTIS HC A06/MF A01 CSCL 01C

The simulation experiment described addresses the effects of structural flexibility on the dynamic characteristics of a generic family of aircraft. The simulation was performed using the NASA Langley VMS simulation facility. The vehicle models were obtained as part of this research. The simulation results include complete response data and subjective pilot ratings and comments and so allow a variety of analyses. The subjective ratings and analysis of the time histories indicate that increased flexibility can lead to increased tracking errors, degraded handling qualities, and changes in the frequency content of the pilot inputs. These results, furthermore, are significantly affected by the visual cues available to the pilot. Author

**N88-14100*#** Flight Systems, Inc., Newport Beach, Calif.
**IMPACT OF FLYING QUALITIES ON MISSION EFFECTIVENESS FOR HELICOPTER AIR COMBAT, VOLUME 1**
T. M. Harris and D. A. Beerman Jun. 1983 105 p Sponsored in part by Army Aviation Systems Command, Moffett Field, Calif.
(Contract NAS2-11178)
(NASA-CR-166568; NAS 1.26:166568; TR-87-A-1) Avail: NTIS HC A06/MF A01 CSCL 01C

A computer simulation to investigate the impact of flying qualities on mission effectiveness is described. The objective of the study was to relate the effects of flying qualities, such as precision of flight path control and pilot workload, to the ability of a single Scout helicopter, or helicopter team, to accomplish a specified anti-armor mission successfully. The model of the actual engagement is a Monte Carlo simulation that has the capability to assess the effects of helicopter characteristics, numbers, tactics and weaponization on the force's ability to accomplish a specific mission against a specified threat as a function of realistic tactical factors. A key feature of this program is a simulation of micro-terrain features and their effects on detection, exposure, and masking for nap-of-the-earth (NOE) flight. Author

**N88-14101*#** Boeing Co., Wichita, Kans.
**DESIGN VERIFICATION AND FABRICATION OF ACTIVE CONTROL SYSTEMS FOR THE DAST ARW-2 HIGH ASPECT RATIO WING, PART 1**
C. R. McGehee Jan. 1986 334 p
(Contract NAS1-16010)
(NASA-CR-177959-Pt-1; NAS 1.26:177959-Pt-1; BMAC-D500-10897-1) Avail: NTIS HC A15/MF A01 CSCL 01C

A study was conducted under Drones for Aerodynamic and Structural Testing (DAST) program to accomplish the final design and hardware fabrication for four active control systems compatible with and ready for installation in the NASA Aeroelastic Research Wing No. 2 (ARW-2) and Firebee II drone flight test vehicle. The wing structure was designed so that Active Control Systems (ACS) are required in the normal flight envelope by integrating control system design with aerodynamics and structure technologies. The DAST ARW-2 configuration uses flutter suppression, relaxed static stability, and gust and maneuver load alleviation ACS systems, and an automatic flight control system. Performance goals and criteria were applied to individual systems and the systems collectively to assure that vehicle stability margins, flutter margins, flying qualities and load reductions are achieved. Author

**N88-14102*#** Boeing Co., Wichita, Kans.
**DESIGN VERIFICATION AND FABRICATION OF ACTIVE CONTROL SYSTEMS FOR THE DAST ARW-2 HIGH ASPECT RATIO WING. PART 2: APPENDICES**
C. R. McGehee Jan. 1986 389 p
(Contract NAS1-16010)
(NASA-CR-177959-Pt-2; NAS 1.26:177959-Pt-2; BMAC-D500-10897-1) Avail: NTIS HC A17/MF A01 CSCL 01C

This is Part 2-Appendices of a study conducted under Drones for Aerodynamic and Structural Testing (DAST) Program to accomplish the final design and hardware fabrication for four active control systems compatible with and ready for installation in the NASA Aeroelastic Research Wing No. 2 (ARW-2) and Firebee II drone flight test vehicle. The wing structure was designed so that Active Control Systems (ACS) are required in the normal flight envelope by integrating control system design with aerodynamics and structure technologies. The DAST ARW-2 configuration uses flutter suppression, relaxed static stability, and gust and maneuver load alleviation ACS systems, and an automatic flight control system. Performance goals and criteria were applied to individual systems and the systems collectively to assure that vehicle stability margins, flutter margins, flying qualities, and load reductions were achieved. Author

# 09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

For related information see also *14 Ground Support Systems and Facilities (Space).*

**N88-14103#** Science Research Council, Chilton (England).
**TWO DIGITAL X-RAY IMAGING SYSTEMS FOR APPLICATIONS IN X-RAY DIFFRACTION**
J. E. Bateman, J. F. Connolly, R. Stephenson, A. C. Flesher, and C. J. Bryant Aug. 1986 41 p
(PB87-123683; RAL-86-064) Avail: NTIS HC E04/MF E04 CSCL 14B

Two digital X-ray imaging systems developed at the Rutherford Appleton Laboratory, the Mark I and the Mark II, are described. Both use a bidimensionally sensitive MultiWire Proportional Counter as the basic X-ray image transducer coupled, in the case of the Mark I to a Digitial LSI 11-23 microcomputer system via CAMAC, and in the case of the Mark II to a Digital LSI 11-73 microcomputer system via custom-built data acquisition hardware mounted directly

on the Q-bus of the microcomputer. The Mark I system provides the advantages of high speed, high sensitivity digital imaging directly into the computer with the potential for software control of the sample orientation and environment. The Mark II system adds the novel features of signal averaging and multiframe exposures. GRA

**N88-14104#** Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain). Dept. de Avionica y Electrooptica.
**METROLOGY AND CALIBRATING LABORATORIES [LABORATORIOS DE METROLOGIA Y CALIBRACION]**
D. VicenteChimenti 1987 26 p In SPANISH; ENGLISH summary
(ETN-88-90761) Avail: NTIS HC A03/MF A01

Measurement of mass, pressure, temperature, electrical current, frequency, and RF and microwave radiations is described. The system of standards at the institution is outlined. ESA

**N88-14105#** Duits-Nederlandse Windtunnel, North East Polder (Netherlands).
**DUTCH-GERMAN WIND TUNNEL'S TENTH ANNIVERSARY**
1987 25 p Presented in East Polder, Netherlands, 22 Oct. 1986 Original contains color illustrations
(ETN-88-91350) Avail: NTIS HC A03/MF A01

The position of the Netherlands aerospace industry in Dutch society; the role of the Dutch-German wind tunnel (DNW) in aircraft development; and the status and prospects of DNW were discussed. ESA

**N88-14106#** Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.
**A LABORATORY STUDY OF ASPHALT CONCRETE MIX DESIGNS FOR HIGH-CONTACT PRESSURE AIRCRAFT TRAFFIC Final Report, Oct. 1983 - Jun. 1986**
George L. Regan Jul. 1987 112 p
(Contract MIPR-N-83-05; AF Proj. 210-4)
(AD-A185753; AFESC/ESL-TR-85-66) Avail: NTIS HC A06/MF A01 CSCL 13C

Effects of high-contact pressure F-4 and F-15 aircraft traffic in the 350-400 psi range on conventionally designed heavy-duty asphalt concretes were studied. Specimens of mix were prepared to current heavy-duty compactive efforts (75 blow per side with an impact hammer) and four other compactive efforts, using a modified gyratory compactor. The gyratory compactor was used to roughly simulate high-contact pressure traffic on some of the mixes. Two aggregate gradations recommended for high-pressure traffic were used to produce crushed limestone aggregate blends. Two grades of asphalt cement, AC 20 and AC 40, and a Chemkrete modified AC 20 asphalt cement were used as binders. Heavy-duty mix selection criteria were used to bracket optimum mixes for supplemental testing and analysis. Testing consisted of indirect tensile tests (dynamic and static), direct shear tests. Accelerated aging tests, and unconfined creep tests. Results indicated that current heavy-duty mix selection criteria can be used, but higher compactive effort is needed to prevent rutting and densification problems. Lower asphalt content mixes were selected when higher compactive efforts were used. Two modified methods of designing high-contact pressure asphalt concrete mixes were presented. The preferred method is based on the use of a gyratory compactor at a higher compactive is not effort. The second method, an approximate method for use when a gyratory compactor is not available, is based on use of the current 75 blow per side impact hammer. Several mixes were recommended for use in a field test at Tyndall AFB, Florida. GRA

**N88-14107#** Transportation Research Board, Washington, D.C.
**MEASURING AIRPORT LANDSIDE CAPACITY**
1987 202 p
(PB88-102637; TRB/TRR/SR-215; ISBN-0-309-04457-X; LC-87-22021) Avail: NTIS HC A10/MF A01 CSCL 01E

Congestion at airport terminal buildings, access roads, and parking areas increasingly threatens the capability of airports to serve additional passengers and air cargo. Measuring the capacity of these airport landside facilities and services is becoming as critical to operations of major airports as capacity measurements for the airside taxiways and runways that serve aircraft. Part 1 of the report contains a general description of the airport landside, how landside capacity is defined and measured, a process for landside capacity assessment, and research needs. In Part 2 guidance is presented for applying these definitions and the process to specific landside functional components likely to represent constraints on the airport's ability to satisfy demand. GRA

# 12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

No abstracts in this category.

# 13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

**N88-14108*#** Texas Univ., Austin. Center for Space Research.
**ADVANCED SIMULATION AND ANALYSIS OF A GEOPOTENTIAL RESEARCH MISSION Semiannual Status Report**
B. E. Schutz Jan. 1988 33 p
(Grant NAG5-528)
(NASA-CR-182355; NAS 1.26:182355) Avail: NTIS HC A03/MF A01 CSCL 22A

Computer simulations have been performed for an orbital gradiometer mission to assist in the study of high degree and order gravity field recovery. The simulations were conducted for a satellite in near-circular, frozen orbit at a 160-km altitude using a gravitational field complete to degree and order 360. The mission duration is taken to be 32 days. The simulation provides a set of measurements to assist in the evaluation of techniques developed for the determination of the gravity field. Also, the simulation provides an ephemeris to study available tracking systems to satisfy the orbit determination requirements of the mission. Author

**N88-14109*#** Texas Univ., Austin. Center for Space Research.
**SIMULATION AND ANALYSIS OF A GEOPOTENTIAL RESEARCH MISSION**
Lisa K. White Dec. 1987 214 p
(Grant NAG5-528)
(NASA-CR-182354; NAS 1.26:182354; CSR-87-2) Avail: NTIS HC A10/MF A01 CSCL 22A

Methods for the determination of the initial conditions for the two satellites that will satisfy Geopotential Research Mission (GRM) requirements are investigated. For certain gravitational recovery techniques, the satellites must remain close to a specified separation distance and their groundtracks must repeat after a specified interval of time. Since the objective of the GRM mission is to improve the gravity model, any pre-mission orbit predicted using existing gravity models will be in error. A technique has been developed to eliminate the drift between the two satellites caused by gravitational modeling errors and return them to repeating groundtracks. The concept of frozen orbits, which minimize altitude variations over given latitudes, was investigated. Finally, the effects of temporal perturbations on the relative range-rate signal were studied. At the proposed altitude of 160 km, the range-rate signal produced by perturbations other than the static geopotential field are dominated by the luni-solar effect. This study demonstrates that the combined effects of all the temporal perturbations does not prevent the orbit from being frozen or the satellites from obtaining a repeating groundtrack to within a specified closure distance. Author

**N88-14110*#** Ohio State Univ., Columbus. ElectroScience Lab.
**ENGINEERING CALCULATIONS FOR THE DELTA S METHOD OF SOLVING THE ORBITAL ALLOTMENT PROBLEM**
P. A. Kohnhorst, C. A. Levis, and E. K. Walton Oct. 1987 224 p
(Grant NAG3-159)
(NASA-CR-182372; NAS 1.26:182372; ESL-TR-718688-6) Avail: NTIS HC A10/MF A01 CSCL 22A

The method of calculating single-entry separation requirements for pairs of satellites is extended to include the interference on the top link as well as on the down link. Several heuristic models for analyzing the effects of shaped-beam antenna designs on required satellite separations are introduced and demonstrated with gain contour plots. The calculation of aggregate interference is extended to include the effects of up-link interference. The relationship between the single-entry C/I requirements, used in determining satellite separation constraints for various optimization procedures, and the aggregate C/I values of the resulting solutions is discussed. Author

# 14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

**N88-14877*#** Texas Southern Univ., Houston. Dept. of Computing and Applied Sciences.
**SPECTROSCOPIC INVESTIGATIONS AND MEASUREMENTS OF CERTAIN ARC JET PARAMETERS Final Report**
Vedula S. Murty *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 18 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 18 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 14B

# 15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles.

For related information see also *20 Spacecraft Propulsion and Power.*

**N88-14111** Michigan Univ., Ann Arbor.
**OPTIMAL GUIDANCE OF HOMING MISSILES Ph.D. Thesis**
Shigeru Ashida 1987 189 p
Avail: Univ. Microfilms Order No. DA8720235

The optimal guidance of homing missiles is studied. The guidance objective is to determine a missile flight trajectory which provides zero or acceptably small miss distance. The objective is regarded as the realization of constant bearing solution for some time interval prior to target intercept. The reference solution cannot be realized by either the conventional proportional navigation guidance law, or the linear optimal feedback guidance law. To overcome this, a new modeling technique is utilized to accommodate any engagement condition, and a more realistic optimal control problem is formulated. The derived guidance law is a nonlinear feedback controller which is called proportional big-bang guidance (PBG). The PBG scheme can take into account initial launch heading errors, autopilot dynamics, target maneuvers, and missile speed changes until the terminal constraint is realized. Dissert. Abstr.

**N88-14112*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**HYDROBURST TEST OF A CARBON-CARBON INVOLUTE EXIT CONE**
Roy M. Sullivan Jan. 1986 33 p
(NASA-TP-2556; NAS 1.60:2556) Avail: NTIS HC A03/MF A01 CSCL 20H

A hydroburst test of the aft portion of the PAM-D exit cone and the test procedure are described in detail. The hydrostatic pressure required to buckle the cone was 9.75 psi. Meanwhile, the PAM-D exit cone was modeled using the finite element method and a theoretical bucking pressure (8.76 psi) was predicted using the SPAR finite element code. The modeling technique employed is discussed. By comparing the theoretical to predicted critical pressures, this report verifies the modeling technique and calculates a material knockdown factor for the carbon-carbon exit cone. Author

# 16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

For related information see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits see *54 Man/System Technology and Life Support.*

**N88-14890*#** Northeastern Univ., Boston, Mass. Dept. of Chemical Engineering.
**RAMAN SPECTRA OF ADSORBED LAYERS ON SPACE SHUTTLE AND AOTV THERMAL PROTECTION SYSTEM SURFACE Final Report**
Ronald J. Willey *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 22 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 22 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 22B

# 17 SPACE COMM., SPACECRAFT COMM., COMMAND & TRACKING

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

No abstracts in this category.

# 18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics,* and *16 Space Transportation.*

**N88-14113*#** Lockheed-Georgia Co., Marietta.
**FEASIBILITY STUDY OF A CARBON DIOXIDE OBSERVATIONAL PLATFORM SYSTEM. VOLUME 1: TECHNICAL Final Report, Dec. 1986**
D. L. Bouquet, D. W. Hall, and R. P. McElveen Dec. 1987 209 p

(Contract NAS8-36600)
(NASA-CR-179225; NAS 1.26:179225) Avail: NTIS HC A10/MF A0* CSCL 22B

The Carbon Dioxide Observational Platform System (CO-OPS) is a near-space, geostationary, multi-user, unmanned microwave powered monitoring platform system. This systems engineering feasibility study addressed identified existing requirements such as: carbon dioxide observational data requirements, communications requirements, and eye-in-the-sky requirements of other groups like the Defense Department, the Forestry Service, and the Coast Guard. In addition, potential applications in: earth system science, space system sciences, and test and verification (satellite sensors and data management techniques) were considered. The eleven month effort is summarized. Past work and methods of gathering the required observational data were assessed and rough-order-of magnitude cost estimates have shown the CO-OPS system to be most cost effective (less than $30 million within a 10 year lifetime). It was also concluded that there are no technical, schedule, or obstacles that would prevent achieving the objectives of the total 5-year CO-OPS program.
Author

**N88-14114*#** Lockheed-Georgia Co., Marietta.
**FEASIBILITY STUDY OF A CARBON DIOXIDE OBSERVATIONAL PLATFORM SYSTEM. VOLUME 2: PROGRAMMATICS**
D. L. Bouquet, D. W. Hall, and R. P. McElveen Dec. 1986 15 p
(Contract NAS8-36600)
(NASA-CR-180404; NAS 1.26:180404) Avail: NTIS HC A03/MF A01 CSCL 22B

The Carbon Dioxide Observational Platform System (CO-OPS) Work Breakdown Structure (WBS) elements are defined. The cost estimates were derived during the parametric analyses conducted for the pre-phase A CO-OPS study. The methodology presented is very preliminary but is adequate for the economic analysis appropriate to (the conceptual) level of design. Costs are presented for ground power, data communications package, system engineering, operations, maintenance, and facilities. Also presented is the total program funding schedule.
B.G.

**N88-14115*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**CONTINUUM MODELING OF LARGE LATTICE STRUCTURES: STATUS AND PROJECTIONS**
Ahmed K. Noor and Martin M. Mikulas, Jr. Feb. 1988 79 p
(NASA-TP-2767; L-16360; NAS 1.60:2767) Avail: NTIS HC A05/MF A01 CSCL 22B

The status and some recent developments of continuum modeling for large repetitive lattice structures are summarized. Discussion focuses on a number of aspects including definition of an effective substitute continuum; characterization of the continuum model; and the different approaches for generating the properties of the continuum, namely, the constitutive matrix, the matrix of mass densities, and the matrix of thermal coefficients. Also, a simple approach is presented for generating the continuum properties. The approach can be used to generate analytic and/or numerical values of the continuum properties.
Author

**N88-14116*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**AN ANALYSIS OF THE EFFECT OF AEROASSIST MANEUVERS ON ORBITAL TRANSFER VEHICLE PERFORMANCE**
Gregory O. Murphy and William T. Suit Sep. 1987 21 p
(NASA-TM-89117; NAS 1.15:89117) Avail: NTIS HC A03/MF A01 CSCL 22B

This paper summarizes a Langley Research Summer Scholars (LARSS) research project (Summer 1986) dealing with the topic of the effectiveness of aeroassist maneuvers to accomplish a change in the orbital inclination of an Orbital Transfer Vehicle (OTV). This task was subject to OTV design constraints, chief of which were the axial acceleration and the aerodynamic heating rate limits of the OTV. The use of vehicle thrust to replace lost kinetic energy and, thereby, to increase the maximum possible change in orbital inclination was investigated. A relation between time in the hover orbit and payload to LEO was established. The amount of plane change possible during this type of maneuver was checked for several runs and a possible thrusting procedure to increase the plane change and still get to LEO was suggested. Finally, the sensitivity of various target parameters to controllable independent variables was established, trades between the amount of control allowed, and payload to LEO suggested.
Author

**N88-14117*#** Martin Marietta Aerospace, Denver, Colo.
**CONCEPT DEFINITION STUDY FOR RECOVERY OF TUMBLING SATELLITES. VOLUME 2: SUPPORTING RESEARCH AND TECHNOLOGY REPORT Final Technical Report**
D. A. Cable, W. L. DeRocher, Jr., J. A. Cathcart, M. G. Keeley, L. Madayev, T. K. Nguyen, and J. R. Preese Jun. 1986 13 p
(Contract NAS8-36609)
(NASA-CR-179229; NAS 1.26:179229; MCR-86-1329-Vol-2; DPD-654; DR-6; DR-7) Avail: NTIS HC A03/MF A01 CSCL 22B

A number of areas of research and laboratory experiments were identified which could lead to development of a cost efficient remote, disable satellite recovery system. Estimates were planned of disabled satellite motion. A concept is defined as a Tumbling Satellite Recovery kit which includes a modular system, composed of a number of subsystem mechanisms that can be readily integrated into varying combinations. This would enable the user to quickly configure a tailored remote, disabled satellite recovery kit to meet a broad spectrum of potential scenarios. The capability was determined of U.S. Earth based satellite tracking facilities to adequately determine the orientation and motion rates of disabled satellites.
E.R.

**N88-14118*#** Martin Marietta Aerospace, Denver, Colo.
**CONCEPT DEFINITION STUDY FOR RECOVERY OF TUMBLING SATELLITES. VOLUME 1: EXECUTIVE SUMMARY, STUDY RESULTS Final Technical Report**
D. A. Cable, W. L. DeRocher, Jr., J. A. Cathcart, M. G. Keeley, L. Madayev, T. K. Nguyen, and J. R. Preese Jun. 1986 212 p
(Contract NAS8-36609)
(NASA-CR-179228; NAS 1.26:179228; MCR-86-1329-Vol-1; DPD-654; DR-6) Avail: NTIS HC A10/MF A01 CSCL 22B

The first assessment is made of the design requirements and conceptual definition of a front end kit to be transported on the currently defined Orbital Maneuvering Vehicle (OMV) and the Space Transportation System Shuttle Orbiter, to conduct remote, teleoperated recovery of disabled and noncontrollable, tumbling satellites. Previous studies did not quantify the dynamic characteristics of a tumbling satellite, nor did they appear to address the full spectrum of Tumbling Satellite Recovery systems requirements. Both of these aspects are investigated with useful results.
Author

**N88-14119#** Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Bereich Raumfahrt.
**TESTING OF HEAT PIPES ON SPAS-01 Final Report, Jun. 1985**
Robert Bosch Bonn, Fed. Republic of Germany BMFT Dec. 1986 260 p In GERMAN; ENGLISH summary Sponsored by BMFT
(BMFT-FB-W-86-014; ISSN-0170-1339; ETN-88-99905) Avail: NTIS HC A12/MF A01; Fachinformationszentrum, Karlshruhe, Fed. Republic of Germany DM 42.50

Heat pipe concepts were tested on a heat pipe Experiment Support Panel in a Space Shuttle orbit, in order to check their usefulness for space applications. The main objective was to know the influence of the zero-gravity environment on the heat pipe operation characteristics as well as on the usefulness of heat pipes as components for thermal control tasks. The performance data of the heat pipes achieved during SPAS-01 missions (STS-7 and STS-11) are presented. The qualification of the different heat pipe systems for space applications is described.
ESA

**N88-14120#** Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Strategiques et Spatiaux.
**RENDEZVOUS AND DOCKING VERIFICATION (RVDV) AND IN-ORBIT DEMONSTRATION, EXECUTIVE SUMMARY Final Report**
H. P. Nguyen Paris, France ESA 11 Feb. 1987 89 p
(Contract ESA-6493/85-NL)
(RVD-RVDV-FR-AS-01; SE/LS/AP-33-994; ESA-CR(P)-2452; ETN-88-91149) Avail: NTIS HC A05/MF A01

Space rendezvous and docking (RVD) items to be verified, and verification methods from ground analysis/simulation to in-orbit testing, are listed. Space missions for 1988 to 1993 were reviewed for opportunities to implement elements of the verification plan. A global RVD demonstration mission in low Earth orbit is designed to complete the verification cycle. Platforms EURECA A and EURECA B are designated as target and chaser vehicles, one being retrieved, the other deployed during one flight of the space shuttle. Nearly no in-orbit experiment is necessary before final system demonstration for verification proper. However technology demonstrations in-orbit are of high interest to increase confidence of users and political partners. ESA

**N88-14121#** Rensselaer Polytechnic Inst., Troy, N.Y.
**STUDIES OF THE STRUCTURAL DYNAMIC BEHAVIOR OF SATELLITE ANTENNA SYSTEM Final Report, 1 Sep. 1983 - 29 Jun. 1987**
Robert G. Loewy 29 Jun. 1987 28 p
(Grant AF-AFOSR-0348-83)
(AD-A185526; AFOSR-87-1167TR) Avail: NTIS HC A03/MF A01 CSCL 22B

A Transfer Matrix (TM) Analysis is formulated to predict the natural modes and frequencies of hoop-maypole type satellite antenna systems. Two directions of bending, axial extension/compression and torsion are represented as coupled by feed assemblies canted with respect to the mast, solar panels tilted out of the plane of the center structure and masses offset from the mast centerline. Shear deflections, large steady cable loads and large compressive loads are accounted for in appropriate members. Using properties chosen as representative of such structures, trends are predicted with variations in size and configuration for several simplified configurations; these include, (a) two-dimensional cable-suspended rigid bars on a flexible center body (mast), (b) T and H -shaped center body sub structures in two and three-dimensional vibrations and (c) cable-stiffened, planar polygonal hoop assemblies. In the last of these cyclic symmetry had to be invoked to avoid numerical difficulties. Some general conclusions are drawn regarding the free vibrations of such structures. The TM approach is seen as a viable alternative to FEM analyses, when structures are encountered which have major substructures with one dimension longer than its others. Full use of the TM analysis for hoop-maypole type structures must await a reformulation in which cyclic symmetry can be invoked, as in the plane hoop cases. GRA

**N88-14122#** Hughes Research Labs., Malibu, Calif.
**FLIGHT MODEL DISCHARGE SYSTEM Report, Dec. 1985 - Feb. 1987**
R. R. Robson, W. S. Williamson, and J. Santoru Apr. 1987 92 p
(Contract F19628-83-C-0143)
(AD-A185657; AFGL-TR-87-0143; SR-3) Avail: NTIS HC A05/MF A01 CSCL 22B

The Flight Model Discharge System (FMDS) Program has completed its third year. The FMDS is a spacecraft charge-control system designed to overcome the problem of charge buildup on a space vehicle which occurs during periods of adverse space environmental conditions. An overview of the FMDS system is presented, followed by an in-depth treatment of the significant technical developments that have occured during the past year. The major areas covered include the plasma generator lifetest and the system thermal analysis. GRA

**N88-14123*#** General Research Corp., McLean, Va. Space Systems Operations.
**TETHERS IN SPACE HANDBOOK**
T. G. Reese, W. A. Baracat, and C. L. Butner Aug. 1986 266 p
(Contract NASw-3921)
(NASA-CR-181371; NAS 1.26:181371) Avail: NTIS HC A12/MF A01 CSCL 22B

The handbook provides a list and description of ongoing tether programs. This includes the joint U.S.-Italy demonstration project, and individual U.S. and Italian studies and demonstration programs. An overview of the current activity level and areas of emphasis in this emerging field is provided. The fundamental physical principles behind the proposed tether applications are addressed. Four basic concepts of gravity gradient, rotation, momentum exchange, and electrodynamics are discussed. Information extracted from literature, which supplements and enhances the tether applications is also presented. A bibliography is appended. B.G.

**N88-14218#** Joint Publications Research Service, Arlington, Va.
**COUNTRY PLANS THREE-AXIS WEATHER SATELLITE Abstract Only**
*In its* JPRS Report: Science and Technology. Japan 23 Sep. 1987 p 31 Transl. into ENGLISH from Aerospace Japan-Weekly (Tokyo, Japan), 3 Aug. 1987 p 5, 6 (For primary document see N88-14213 06-31)
Avail: NTIS HC A05/MF A01

**N88-14885*#** Alabama A & M Univ., Normal. Dept. of Physics.
**ANALYSIS AND INTERPRETATION OF SATELLITE FRAGMENTATION DATA Final Report**
Arjun Tan *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 20 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 22B

# 19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

# 20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxilliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

**N88-14124#** Naval Postgraduate School, Monterey, Calif.
**MEASUREMENT OF PARTICLE SIZE DISTRIBUTION IN A SOLID PROPELLANT ROCKET MOTOR USING LIGHT SCATTERING M.S. Thesis**
Ted E. Pruitt Jun. 1987 94 p
(AD-A184875) Avail: NTIS HC A05/MF A01

Research was conducted to determine the particle size distribution in the motor and exhaust of a small solid propellant rocket motor using light-scattering techniques. A commercially produced MALVERN 2600 Particle Sizer was used in conjunction with a locally designed light-scattering apparatus. The physical dimensions of the motor windows limited the minimum measurable

particle size to roughly 3.5 microns. Motor data was repeatable and agreement between light-scattering systems was within approximately 7 percent. A large particle bias was evident. The source of this bias was believed to be the RTV used for bonding and inhibiting. GRA

**N88-14125*#** Lockheed Missiles and Space Co., Huntsville, Ala. Computational Mechanics Section.
**ANALYSIS OF INTERNAL FLOWS RELATIVE TO THE SPACE SHUTTLE MAIN ENGINE Final Report**
30 Dec. 1987 41 p
(Contract NAS8-35984)
(NASA-CR-179240; NAS 1.26:179240; LMSC-HEC-TR-F225770)
Avail: NTIS HC A03/MF A01 CSCL 21H

Cooperative efforts between the Lockheed-Huntsville Computational Mechanics Group and the NASA-MSFC Computational Fluid Dynamics staff has resulted in improved capabilities for numerically simulating incompressible flows generic to the Space Shuttle Main Engine (SSME). A well established and documented CFD code was obtained, modified, and applied to laminar and turbulent flows of the type occurring in the SSME Hot Gas Manifold. The INS3D code was installed on the NASA-MSFC CRAY-XMP computer system and is currently being used by NASA engineers. Studies to perform a transient analysis of the FPB were conducted. The COBRA/TRAC code is recommended for simulating the transient flow of oxygen into the LOX manifold. Property data for modifying the code to represent LOX/GOX flow was collected. The ALFA code was developed and recommended for representing the transient combustion in the preburner. These two codes will couple through the transient boundary conditions to simulate the startup and/or shutdown of the fuel preburner. A study, NAS8-37461, is currently being conducted to implement this modeling effort. Author

**N88-14126*#** Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
**ADVANCED ELECTRIC PROPULSION AND SPACE PLASMA CONTACTOR RESEARCH Annual Report**
Paul J. Wilbur Jan. 1987 163 p
(Grant NGR-06-002-112)
(NASA-CR-180862; NAS 1.26:180862) Avail: NTIS HC A08/MF A01 CSCL 21C

A theory of the plasma contacting process is described and experimental results obtained using three different hollow cathode-based plasma contactors are presented. The existence of a sheath across which the bulk of the voltage drop associated with the contacting process occurs is demonstrated. Test results are shown to agree with a model of a spherical, space-charge-limited double sheath. The concept of ignited mode contactor operation is discussed, which is shown to enhance contactor efficiency when it is collecting electrons. An investigation of the potentials in the plasma plumes downstream of contactors operating at typical conditions is presented. Results of tests performed on hollow cathodes operating at high interelectrode pressures (up to about 1000 Torr) on ammonia are presented and criteria that are necessary to ensure that the cathode will operate properly in this regime are presented. These results suggest that high pressure hollow cathode operation is difficult to achieve and that special care must be taken to assure that the electron emission region remains diffuse and attached to the low work function insert. Experiments conducted to verify results obtained previously using a ring cusp ion source equipped with a moveable anode are described and test results are reported. A theoretical study of hollow cathode operation at high electron emission currents is presented. Preliminary experiments using the constrained sheath optics concept to achieve ion extraction under conditions of high beam current density, low net accelerating voltage and well columniated beamlet formation are discussed. Author

**N88-14127*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**AUXILIARY PROPULSION TECHNOLOGY FOR ADVANCED EARTH-TO-ORBIT VEHICLES**
Steven J. Schneider 1987 16 p Presented at the 1987 JANNAF Propulsion Conference, San Diego, Calif., 15-17 Dec. 1987
(NASA-TM-100237; E-3783; NAS 1.15:100237) Avail: NTIS HC A03/MF A01 CSCL 21H

The payload which can be delivered to orbit by advanced Earth-to-Orbit vehicles is significantly increased by advanced subsystem technology. Any weight which can be saved by advanced subsystem design can be converted to payload at Main Engine Cut Off (MECO) given the same launch vehicle performance. The auxiliary propulsion subsystem and the impetus for the current hydrogen/oxygen technology program is examined. A review of the auxiliary propulsion requirements of advanced Earth-to-Orbit (ETO) vehicles and their proposed missions is given first. Then the performance benefits of hydrogen/oxygen auxiliary propulsion are illustrated using current shuttle data. The proposed auxiliary propulsion subsystem implementation includes liquid hydrogen/liquid oxygen (LH2/LO2) primary Reaction Control System (RCS) engines and gaseous hydrogen/gaseous oxygen (GH2/GO2) vernier RCS engines. A distribution system for the liquid cryogens to the engines is outlined. The possibility of providing one dual-phase engine that can operate on either liquid or gaseous propellants is being explored, as well as the simultaneous firing of redundant primary RCS thrusters to provide Orbital Maneuvering System (OMS) level impulse. Scavenging of propellants from integral main engine tankage is proposed to utilize main engine tank residuals and to combine launch vehicle and subsystem reserves. Author

**N88-14128#** Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
**PERFORMANCE-LIMITING FACTORS IN MPD THRUSTERS Final Report, 15 Dec. 1984 - 30 Apr. 1986**
Manuel Martinez-Sanchez 17 Apr. 1987 57 p
(Grant AF-AFOSR-0035-83)
(AD-A185605; AFOSR-87-1353TR) Avail: NTIS HC A04/MF A01 CSCL 21C

The following results: (a) A theoretical formulation of the flow of plasma in a variable area accelerator under conditions where the voltage is dominated by the back e.m.f., showing novel features akin to those found in ordinary gas dynamics, but with the magnetoacoustic speed playing the controlling role. (b) A numerical model of an axisymmetric MPD thruster of realistic geometry with fully coupled gas and electrodynamic effects, but limited by numerical difficulties to conditions well below onset. (c) design and construction of test channels to investigate the effects predicted by the above theories, and (d) Generation of a limited computerized MPD data predicted by the above theories, and (d) Generation of a limited computerized MPD data base. Maqueto plasmadynamic thruster; electric propulsion. GRA

**N88-14129#** SeiTec, Cleveland, Ohio.
**COMPLETELY MAGNETICALLY CONTAINED ELECTROTHERMAL THRUSTERS Final Technical Report, Sep. 1984 - Aug. 1985**
George R. Seikel and Clifford V. Franks 5 Jul. 1987 47 p
(Contract F49620-84-C-0114)
(AD-A185674; SEITEC-8715; AFOSR-87-1164TR) Avail: NTIS HC A03/MF A01 CSCL 21C

Conceptual designs of potentially attractive high-performance thrusters are defined. These are a kw steady-state radiation-cooled DC thruster and a MW quasi-steady DC thruster. These thrusters offer the potential for long operating life with low erosion rates and 50 to 100 percent improvements in performance over prior plasma thrusters. The kw thruster would be a prototype of a radiation-cooled electric thruster for future electric propulsion missions. The MW thruster would be an inexpensive experiment to define the potential of subsequent very-high power, steady-state thrusters which would utilize superconducting magnets. The kw

thruster would use xenon propellent and the MW thruster would use argon propellent. Both should operate at efficiencies of 50 to 80 percent in the 2500 to 3000 second specific impulse range.
GRA

# 23 CHEMISTRY AND MATERIALS (GENERAL)

**N88-14130#** Joint Publications Research Service, Arlington, Va.
**JPRS REPORT: SCIENCE AND TECHNOLOGY. JAPAN**
6 Oct. 1987 112 p Transl. into ENGLISH from various Japanese articles
(JPRS-JST-87-028) Avail: NTIS HC A06/MF A01

Translated articles from periodicals and journals of Japan are presented. Topics of concern are: Advanced material; Aerospace; Lasers, sensors, optics; and Marine technology. Representative titles are: Gas separation using solid electrolytes described; Pressure induced phase transition, Superconductivity of phosphorus described; Visible boundary layer transition points through flight tests; and High polymer sensor materials discussed. For individual titles, see N88-14131 through N88-14142.

**N88-14131#** Joint Publications Research Service, Arlington, Va.
**GAS SEPARATION USING SOLID ELECTROLYTES DESCRIBED** **c25**
Hiroyasu Iwahara *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 1-14 Transl. into ENGLISH from Kino Zairyo (Tokyo, Japan), Mar. 1987 p 5-12 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

Solid electrolyte gas separation processes still remain in the laboratory test phase. Unlike high molecular membrane and porous diaphragm processes previously used, they are capable of separating a 100 percent pure gas at an advantageous time. Because of this, the processes appear very promising. The principle and features are examined and what gas is capable of being separated by various solid electrolytes are briefly described.
Author

**N88-14132#** Joint Publications Research Service, Arlington, Va.
**NEW APPLICATION OF TRANSITION METAL CARBIDES DETAILED** **c26**
Yoshio Ishizawa *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 15-25 Transl. into ENGLISH from Kino Zairyo (Tokyo, Japan), Mar. 1987 p 13-20 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

Many transition metal family metal carbides are compounds with high melting points of more than 3,000 C. Recently, growth of their monocrystals has become possible with the elucidation of their basic properties. The processes are detailed for manufacturing a surface treated TiC field emitter recently developed as an example of the new application of metal carbides as well as with its electron emission characteristics.
Author

**N88-14133#** Joint Publications Research Service, Arlington, Va.
**MATERIAL DESIGN OF HIGH-PURPOSE GLASS DISCUSSED** **c27**
Itaru Yasui *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 26-39 Transl. into ENGLISH from Kino Zairyo (Tokyo, Japan), Mar. 1987 p 44-53 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

The purpose of glass material planning is to obtain new glass promptly. Its analysis and essence is examined. The history of the application of high temperature, high strength materials is discussed with silicon nitride used as the example.
Author

**N88-14134#** Joint Publications Research Service, Arlington, Va.
**PRESSURE INDUCED PHASE TRANSITIONS, SUPERCONDUCTIVITY OF PHOSPHORUS DESCRIBED** **c76**
Ichimin Shirotani and Haruki Kawamura *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 40-50 Transl. into ENGLISH from Kino Zairyo (Tokyo, Japan), Mar. 1987 p 56-63 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

As temperature and pressure release its molecularity, phosphorus changes in the following order: white to red, rhombic black, rhombohedral black, and simple cubic. During this transition, the physical properties of phosphorus change considerably. In particular, phosphorus show the highest superconductive transition temperature among separate elements. The relationship of its structure and superconductivity is discussed.
Author

**N88-14135#** Joint Publications Research Service, Arlington, Va.
**NAL NEWS UPDATED: FY87 BUSINESS PLAN, DEVELOPMENTS** **c81**
*In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 51-61 Transl. into ENGLISH from Kogiken Nyusu (Tokyo, Japan), May 1987 p 1-14 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

In accordance with the space development program determined by the Space Activities Commission as well as the findings and recommendations of the aviation and electronics technology councils, in the promotion of fiscal 1987 operations: (1) research is proceeding on aviation technology, centering on the establishment of technology considered necessary for the future development of Japanese aircraft; (2) in striving to expand unrestricted space development activity, research and development of space science technology is promoted, aimed at development of the necessary independent technology base; (3) an effort is being made for appropriate maintenance and operation of facilities as a public agency of large test facilities concerned with aerospace technology in Japan; and (4) the conduction of positive support and cooperation with foreign and domestic research and development agencies and research and development of related industries forms the basis for promotion of international cooperation and the organic collaboration of industry, academia, and government to meet the demands of the age.
Author

**N88-14136#** Joint Publications Research Service, Arlington, Va.
**VISIBLE BOUNDARY LAYER TRANSITION POINTS THROUGH FLIGHT TESTS Abstract Only** **c34**
Takeru Onuki *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 61-62 Transl. into ENGLISH from Kogiken Nyusu (Tokyo, Japan), May 1987 p 7-8 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

The problem of the transition from a laminar flow boundary layer to a turbulent flow boundary is a basic problem of fluids such as stability of the laminar flow boundary layer and the mechanism of the shift to the transition. It is also an important research topic in the applications area from the relationship to aircraft friction drag. Stability of a two dimensional laminar flow boundary layer can be estimated by solving the Orr-Sommerfield equation considering minute disturbances analytically, but judgement of the transition point position must depend upon the rules of experience. Also, due to recent advances in large computers, numerical solutions of the Navier-Stokes equation have been made, but the transition point position seems to be half an experience consideration. Consequently, the acquisition of test data on the transition point was basically necessary, but precautions are necessary to control adequately air current characteristics during tests since an inherent air current turbulence exists, though slight, in the wind tunnel. A method for the most reliable flight tests with actual aircraft was considered. A sublimation method was employed, which has a record for making the transition point visible.
Author

**N88-14137#** Joint Publications Research Service, Arlington, Va.
**NUMERICAL SIMULATION OF FLIGHT BODY CIRCUMFERENCE FLOW Abstract Only** **c34**
*In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 62-64 Transl. into ENGLISH from Kogiken Nyusu (Tokyo, Japan), May 1987 p 8-10 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

Large scale numerical calculations have become possible through the introduction of a numerical simulator. A calculation which beforehand would have taken a month or so to obtain the results now can be done in less than an hour. The quality of research in this field depends greatly on the performance of the computer used. In the numerical simulator, a calculation is possible using about 1.5 million grid points for a three dimensional flow. A calculation grid was sought by the method of solving a three dimensional hyperbolic differential equation. If the physical body surface coordinates are assigned by a hyperbolic type grid formation method, the coordinates of the outside are automatically determined by designating the volume forming the base and orthography of the coordinate lines and a excellent grid mesh can be formed comparatively easily for a convex body. Improvement was made to form a non-intersecting grid for a intermixed concavo-convex physical body shape, and the difficulties in a hyprebolic grid formation were overcome. An example of a calculated grid obtained by applying this improved method to the complete NASA shuttle is given. Author

**N88-14138#** Joint Publications Research Service, Arlington, Va.
**RESEARCH ON INTERNAL FLUID MECHANISM BETWEEN TURBINE BLADES Abstract Only** **c34**
Takamasa Yamamoto *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 64-65 Transl. into ENGLISH from Kogiken Nyusu (Tokyo, Japan), May 1987 p 10-11 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

Up to now many turbo engines have been designed and manufactured by the method of determining the most efficient blade shape and blade arrangement based on test data such as cascade loss. In this research, a low speed cascade wind tunnel was manufactured with the objective of a detailed investigation of flow between blades in an axial flow turbine. A clarification was made of the complicated three dimensional flow phenomena and its mechanism, the comprehension of which has been inadequate up to now. For the test cascade, a linear cascade and toroidal cascade were manufactured. First, the flow between blades simplified with no centrifugal force in the linear cascade was measured based on various conditions. Afterwards, the flow in a nearby place in the actual engine with considerable centrifugal force in a toroidal cascade was measured. The results and the current status of the measurements are presented. Author

**N88-14139#** Joint Publications Research Service, Arlington, Va.
**DEVELOPMENT OF TRANSONIC SPEED CASCADE DESIGN METHOD USING EULER CODE AND INVERSE SOLUTION** **c02**
Naoki Yokose *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 65-71 Transl. into ENGLISH from Kogiken Nyusu (Tokyo, Japan), May 1987 p 12-14 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

In the past, computed aerodynamics have been made useful for aerospace technology. Recently, with numerical simulators in full scale operation, practical and useful improvements in analysis and design codes as aerodynamic tools are becoming more rapid. A great advantage has been gained by using computed aerodynamics technology which was developed for transonic blade design and analysis. A NSCAS code, improving and expanding the high Reynolds number transonic Navier-Stokes analysis code NSFOIL, was created and an analysis of the transonic buffet of compressor blades was realized. It is estimated that the WINDES, which realizes a designated pressure distribution as desired, can be applied to cascades, and a design was attempted combining it with a transonic cascade analysis code created by a quick adjustment to the transonic obtuse physical object EULER analysis code. Afterwards, upon completing the structure of a rigid design theory for cascades, a grid mesh creation code capable of easily handling actual turboprop blades, compressors, and turbine blades, was developed. Development of a full scale cascade design method was conducted and good results were obtained. Author

**N88-14140#** Joint Publications Research Service, Arlington, Va.
**HIGH POLYMER SENSOR MATERIALS DISCUSSED** **c27**
Sachio Hirose *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 72-79 Transl. into ENGLISH from Sensor Gijutsu (Tokyo, Japan), Dec. 1986 p 50-53 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

Polymer materials used in various material sensors were reviewed. Gas sensors, meanwhile, largely use ceramics and semiconductors as the raw materials of the elementary conversion device. The gas sensing type of electrode, which detects gases by electrochemical means, uses an ion selection electrode and is classified in the electrode category and is discussed as such. Rain sensors and touch sensors, which may be considered as kinds of material sensors in a wider sense of the term, and in which piezoelectric polymer materials currently being developed are playing a vital role, are omitted. Author

**N88-14141#** Joint Publications Research Service, Arlington, Va.
**POLYMER MATERIALS FOR PRESSURE SENSORS** **c27**
Hiroji Ohigashi and Kiyoto Koyama *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 80-86 Transl. into ENGLISH from Sensor Gijitsu (Tokyo, Japan), Dec. 1986 p 54-57 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

Pressure sensors fall largely into three categories: (1) based on a change of electrical resistance and represented by a strain gauge; (2) based on a change of capacitance and represented by differential pressure sensor; and (3) based on the piezoelectric property as seen in hydrophones. Polymer materials have recently begun to be put to use for pressure sensors mostly for the third group, i.e., as piezoelectric sensors. Piezoelectric material not only serves as a sensor, converting pressure into electrical signals, but also, conversely, as a transducer, generating pressure or sound waves from electrical input. Polymer raw materials for both of these applications are examined. Author

**N88-14142#** Joint Publications Research Service, Arlington, Va.
**POLYMER MATERIAL FOR HEAT SENSORS** **c27**
Ikuo Sato *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 86-93 Transl. into ENGLISH from Sensor Gijitsu (Tokyo, Japan), Dec. 1986 p 58-61 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

Few substances are inert enough to show no changes in their physical property upon external thermal stimulation. In polymer materials, the input signal of thermal changes produces output signals in the form of electrical polarization and resistance. Infrared sensors and thermistors based on this property have been finding practical applications. Changes in the physical property, resulting from thermal changes, represent a phenomenon observed in raw materials in general, not limited to polymers. Therefore, thermal sensors are the most universally used and the most diverse. Polymer materials which permit quantity production are, in turn, readily available and their processability is excellent. They are therefore, being tested as sensors not only in electric blankets and other appliances but also as sensors for medical purposes and, in particular, in the treatment of cancer. Changes in the physical properties of polymer materials resulting from temperature changes are examined and also with their application in material sensors. Author

**N88-14143#** Pennsylvania State Univ., University Park. Center for Advanced Materials.
**PROJECTS WITHIN THE CENTER FOR ADVANCED MATERIALS Annual Report, 1 Jun. 1986 - 31 May 1987**
J. R. Hellmann and B. K. Kennedy Jun. 1987 282 p
(Contract GRI-5084-238-1302)
(PB88-123054; CAM-8701; GRI-87/0256) Avail: NTIS HC A13/MF A01 CSCL 07D

The activities of the Center for Advanced Materials (CAM) are documented for the first year of its operation. Efforts included: (1) an assessment of the potential for using natural gas in ceramic and powder metal sintering technology; (2) identification of important research and development issues in high temperature tribology of advanced ceramic and alloy materials; (3) the definition of issues and opportunities in the development and implementation of a materials properties design data base. In addition, efforts were directed toward establishing mechanisms for disseminating information generated by CAM researchers to the natural gas industry through the development of a newsletter and descriptive brochures, and by hosting workshops, short courses, and conferences. Author

# 24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

For ceramic materials see *27 Nonmetallic Materials.*

**N88-14144*** General Dynamics Corp., San Diego, Calif. Convair Div.
**TIME-TEMPERATURE-STRESS CAPABILITIES OF COMPOSITE MATERIALS FOR ADVANCED SUPERSONIC TECHNOLOGY APPLICATION**
James R. Kerr and James F. Haskins May 1987 675 p
(Contract NAS1-12308)
(NASA-CR-178272; NAS 1.26:178272; GDC-CRAD-85-005)
Avail: NTIS HC A99/MF E03 CSCL 11D

Advanced composites will play a key role in the development of the technology for the design and fabrication of future supersonic vehicles. However, incorporating the material into vehicle usage is contingent on accelerating the demonstration of service capacity and design technology. Because of the added material complexity and lack of extensive data, laboratory replication of the flight service will provide the most rapid method to document the airworthiness of advanced composite systems. Consequently, a laboratory program was conducted to determine the time-temperature-stress capabilities of several high temperature composites. Tests included were thermal aging, environmental aging, fatigue, creep, fracture, tensile, and real-time flight simulation exposure. The program had two phases. The first included all the material property determinations and aging and simulation exposures up through 10,000 hours. The second continued these tests up to 50,000 cumulative hours. This report presents the results of the Phase 1 baseline and 10,000-hr aging and flight simulation studies, the Phase 2 50,000-hr aging studies, and the Phase 2 flight simulation tests, some of which extended to almost 40,000 hours. Author

**N88-14145*#** Acurex Corp., Mountain View, Calif. Aerotherm Div.
**DEVELOPMENT OF AN IMPACT- AND SOLVENT-RESISTANT THERMOPLASTIC COMPOSITE MATRIX, PHASE 4**
C. B. Delano Sep. 1987 118 p
(Contract NAS1-16808)
(NASA-CR-178413; NAS 1.26:178413) Avail: NTIS HC A06/MF A01 CSCL 11D

Polyimides from BTDA with m-phenylenediamine and three aliphatic diamines were prepared in cresol and characterized. Characterization tests included compression strength and modulus, stressed solvent resistance, and melt-flow tests. Efforts to reduce the molecular weights of these polymers by either stoichiometric imbalance or phthalic anhydride end capping produced opacity in the polymer moldings when the stoichiometry was less than 99 percent. Use of 2,4-diaminotoluene in place of the m-phenylenediamine allowed clear polymer moldings to be obtained at all stoichiometries by end capping or stoichiometric imbalance. After melt-flow/molecular-weight studies, carbon fabric composites were prepared from three polyimide compositions containing BTDA, 2,4-diaminotoluene and two aliphatic diamines. Flexural strengths of two of the resins were in excess of 689 MPa (100 ksi) at both room temperature and 93 C. The polyimide from BTDA was selected for scale-up and neat resin characterization tests. The Tg of this polymer was 233 C. Author

**N88-14146** Michigan Univ., Ann Arbor.
**FRACTOGRAPHIC STUDY OF FIBER COMPOSITES Ph.D. Thesis**
Tsung-Yu Pan [1987] 188 p
Avail: Univ. Microfilms Order No. DA8712188

The fracture surface resulting from a crack propagating in a plane parallel to the axes of fibers in uncoated and flexible interlayered unidirectional glass composites was studied by scanning electron microscopy (SEM). The study was conducted on specimens of 1 mm diameter glass rods embedded in epoxy resin. In the uncoated glass specimen, the microscopic study clearly demonstrated that the crack creates a debonding at the glass matrix interface before reaching the glass. It then propagates along the interface and induces secondary cracks and parabolic marks on the polymer side of the interface. After passing over the top of the glass rod, the crack generates a ripple texture on the polymer side of the interface. Finally, the crack reentered the matrix from a small patch of polymer slightly better adhered to the glass surface. The mechanism of fracture energy absorption when a transverse crack propagates in a fiber composite is proposed based on these morphologies. Dissert. Abstr.

**N88-14147** Delaware Univ., Newark.
**TEMPERATURE DEPENDENT MECHANICAL PROPERTIES OF AN ALUMINA FIBER REINFORCED ALUMINUM COMPOSITE Ph.D. Thesis**
Keun-Bae Park [1987] 145 p
Avail: Univ. Microfilms Order No. DA8719545

Elevated temperature mechanical properties and failure behavior of an alpha-alumina/aluminum composite were studied in tension and fatigue. Effects of the test temperature and isothermal exposure on the stress-strain curve, tensile strength, and fatigue lifetime were investigated. Characteristics of the fracture surfaces and the changes of failure mode as a function of temperature were analyzed. Dissert. Abstr.

**N88-14148** Delaware Univ., Newark.
**BEHAVIOR OF BOLTED JOINTS IN COMPOSITE LAMINATES Ph.D. Thesis**
Robert Alan Jurf 1986 229 p
Avail: Univ. Microfilms Order No. DA8719533

An investigation is presented which characterizes bolted joint strength in Kevlar/epoxy and graphite/epoxy (0/45/90-45) sub 25 composite laminates. The fundamental problem of a single bolt hole loaded symmetrically in tension is addressed. The first objective is to generalize the relationships between width, edge distance, hole size, thickness, washer diameter, and degree of lateral constraint with bolted joint strength based on experimental observations. The second objective is to numerically predict the same observation using only lamina properties. The effective laminate behavior is calculated with a nonlinear laminate analysis based on the material and the stacking sequence. The effective laminate properties are input into a nonlinear finite element analysis to model the bolted joint. The degree of lateral surface constraint is also included in the analysis. The predicted bolted joint failure regions and strengths were consistent with the experimental data although improved nonlinear constitutive finite element models are needed. The analysis is useful in predicting critical width, edge distance, and washer sizes needed to optimize bolted joint strength. Dissert. Abstr.

**N88-14149** Delaware Univ., Newark.
**THERMO-MECHANICAL BEHAVIOR OF HIGH TEMPERATURE FIBER COMPOSITES Ph.D. Thesis**
Jin Kim [1987] 186 p
Avail: Univ. Microfilms Order No. DA8719535

Selective thermomechanical behaviors of composites applicable to high temperatures are studied with the semi-numerical scheme. First, solidification induced residual thermal stresses are studied for metal matrix composites. Second, a creep analysis is performed for short fiber reinforced ceramic matrix composites. Finally, the creep analysis of short fiber reinforced ceramic matrix composites is modified and extended to the creep analysis of continuous fiber reinforced ceramic matrix composites. The stress-strain rates of this analysis are compared with those of the rule of mixtures prediction. Dissert. Abstr.

**N88-14150*#** Case Western Reserve Univ., Cleveland, Ohio. Dept. of Material Science and Engineering.
**STRESS RUPTURE BEHAVIOR OF SILICON CARBIDE COATED, LOW MODULUS CARBON/CARBON COMPOSITES M.S. Thesis**
Gary A. Rozak and John F. Wallace Jan. 1988 98 p
(Grant NAG3-464)
(NASA-CR-180863; E-3708; NAS 1.26:180863) Avail: NTIS HC A05/MF A01 CSCL 11D

The disadvantages of carbon-carbon composites, in addition to the oxidation problem, are low thermal expansion, expensive fabrication procedures, and poor off axis properties. The background of carbon-carbon composites, their fabrication, oxidation, oxidation protection and mechanical testing in flexure are discussed. Author

**N88-14151*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**AN INVESTIGATION OF PHYSICAL PROPERTIES OF THERMOPLASTIC POLYIMIDES**
Jag J. Singh and Diane M. Stoakley Dec. 1987 13 p
(NASA-TM-100530; NAS 1.15:100530) Avail: NTIS HC A03/MF A01 CSCL 11D

Thermoplastic polyimides are a class of promising high temperature polymers for aerospace applications. NASA-developed LARC-TPI is a prominent member of this family of polymers. Its physical characteristics have been measured as a function of its curing schedule. The results and their possible interpretations are discussed. Author

**N88-14152#** Societe Nationale Industrielle Aerospatiale, Suresnes (France). Direction Centrale de la Qualite.
**STUDY OF DAMAGE IN CARBON FIBER-EPOXY COMPOSITE MATERIALS. UTILIZATION TO ASSESS BROKEN SPECIMENS Test Report [ETUDE DE L'ENDOMMAGEMENT DES MATERIAUX COMPOSITES A FIBRE CARBONE ET RESINE EPOXY. UTILISATION POUR L'EXPERTISE DES PIECES ROMPUES]**
D. Lang and J. Odorico 15 Jan. 1987 83 p In FRENCH
(Contract DRET-83-35-127)
(DCQ/L-45650/F; ETN-88-91174) Avail: NTIS HC A05/MF A01

Methods to visualize damage in carbon-epoxy composites are developed. The resolution and the applicability of the methods are determined. Visualized damage is characterized for several design, load, and operating conditions including specimen conditioning, static and dynamic loading, load cycles, layer stratification, and specimen geometry. Pictures are presented to illustrate the conclusions. ESA

**N88-14153#** Societe Nationale Industrielle Aerospatiale, Suresnes (France). Direction Centrale de la Qualite.
**FLAW EFFECTS: BEHAVIOR IN OPERATION OF DELAMINATION IN A CROSSED MULTILAYER COMPOSITE SPECIMEN Final Report. Test Report [NOCIVITE DES DEFAUTS: COMPORTEMENT EN SERVICE D'UN DELAMINAGE DANS UN COMPOSITE EN MULTICOUCHES CROISEES]**
J. Odorico and D. Lang 2 Jul. 1987 64 p In FRENCH
(Contract DRET-84-34-462)
(DCQ/L-47-363/F; ETN-88-91175) Avail: NTIS HC A04/MF A01

Observations of cases of defective specimens of carbon fiber/epoxy resin composites are reported. It is shown that the defects do not change the tensile strength, but the loss in compression strength is 5% to 40%. ESA

**N88-14154#** Societe Nationale Industrielle Aerospatiale, Suresnes (France). Direction Centrale de la Qualite.
**MEASUREMENT OF MECHANICAL PARAMETERS TO DEFINE DAMAGE CRITERIA IN DELAMINATION OF CROSSED STRATIFIED LAYERS Final Report [MESURE DE PARAMETRES MECANIQUES POUR L'ELABORATION DE CRITERES D'ENDOMMAGEMENT EN DELAMINAGE SUR STRATIFIES CROISES]**
J. Odorico and B. Soulezelle 6 Jul. 1987 151 p In FRENCH
(Contract DRET-84-34-462-00-470-75-01)
(DCQ/L-47-361/F; ETN-88-91176) Avail: NTIS HC A08/MF A01

Test and computation results were obtained and compared to determine and predict the incidence of layer orientation and assembly specification on the mechanical behavior of carbon fiber-epoxy composites. The mechanical properties of the component layers were studied separately. Different specimen geometries were used. It is shown that a prediction of first delamination damage in crossed layer composites is extremely difficult, while it is possible to predict the stress to initiate transversal cracks and the evolution of their number. It is also possible to evaluate the layer type susceptibility to delamination. ESA

**N88-14155*#** National Academy of Sciences - National Research Council, Washington, D. C. Committee on the Status and Viability of Composite Materials for Aircraft Structures.
**ADVANCED ORGANIC COMPOSITE MATERIALS FOR AIRCRAFT STRUCTURES: FUTURE PROGRAM**
[1987] 112 p
(Contract NASw-4003)
(NASA-CR-181467; NAS 1.26:181467) Avail: NTIS HC A06/MF A01 CSCL 11D

Revolutionary advances in structural materials have been responsible for revolutionary changes in all fields of engineering. These advances have had and are still having a significant impact on aircraft design and performance. Composites are engineered materials. Their properties are tailored through the use of a mix or blend of different constituents to maximize selected properties of strength and/or stiffness at reduced weights. More than 20 years have passed since the potentials of filamentary composite materials were identified. During the 1970s much lower cost carbon filaments became a reality and gradually designers turned from boron to carbon composites. Despite progress in this field, filamentary composites still have significant unfulfilled potential for increasing aircraft productivity; the rendering of advanced organic composite materials into production aircraft structures was disappointingly slow. Why this is and research and technology development actions that will assist in accelerating the application of advanced organic composites to production aircraft is discussed. Author

**N88-14156#** Asahi Glass Co. Ltd., Yokohama (Japan). Research Lab.
**BENDING PROPERTIES OF ALUMINUM BASE COMPOSITE WITH CVD-FIBER**
T. Kobayashi 1986 12 p In JAPANESE Submitted for publication
(PB87-130878) Avail: NTIS HC E07/MF E01 CSCL 11D

Aluminum base composites with CVD fiber were fabricated by flame fusion spraying and hot pressing. The bending modulus and strength of composite were affected by fiber embedded position, and could be estimated from bending stress distribution in each composite. Cyclic bending stress was applied to the composite. One composite endured to 10 to the 7th power cycles, even when the applied stress was as high as 80 percent of its bending

fracture strength, and only a slight decrease in the applied stress was observed during the fatigue test. GRA

**N88-14157*#** Douglas Aircraft Co., Inc., Long Beach, Calif.
**A STUDY OF THE UTILIZATION OF ADVANCED COMPOSITES IN FUSELAGE STRUCTURES OF COMMERCIAL AIRCRAFT Final Report**
D. J. Watts, P. T. Sumida, B. L. Bunin, G. S. Janicki, J. V. Walker, and B. R. Fox Jan. 1985 183 p
(Contract NAS1-17416)
(NASA-CR-172405; NAS 1.26:172405; ACEE-30-FR-3313) Avail: NTIS HC A09/MF A01 CSCL 11D

A study was conducted to define the technology and data needed to support the introduction of advanced composites in the future production of fuselage structure in large transport aircraft. Fuselage structures of six candidate airplanes were evaluated for the baseline component. The MD-100 was selected on the basis of its representation of 1990s fuselage structure, an available data base, its impact on the schedule and cost of the development program, and its availability and suitability for flight service evaluation. Acceptance criteria were defined, technology issues were identified, and a composite fuselage technology development plan, including full-scale tests, was identified. The plan was based on composite materials to be available in the mid to late 1980s. Program resources required to develop composite fuselage technology are estimated at a rough order of magnitude to be 877 man-years exclusive of the bird strike and impact dynamic test components. A conceptual composite fuselage was designed, retaining the basic MD-100 structural arrangement for doors, windows, wing, wheel wells, cockpit enclosure, major bulkheads, etc., resulting in a 32 percent weight savings. Author

**N88-14158*#** Toronto Univ. (Ontario).
**EVALUATION OF CLOSED CUBIC FAILURE CRITERION FOR GRAPHITE/EPOXY LAMINATES Final Report**
R. C. Tennyson and Zhiqing Jiang Apr. 1987 43 p
(Grant NAGw-752)
(NASA-CR-182375; NAS 1.26:182375) Avail: NTIS HC A03/MF A01 CSCL 11D

An analytical method has been developed to ensure closure of the cubic form of the tensor polynomial strength criterion. The intrinsic complexity of the cubic function is such that special conditions must be met to close the failure surface in three-dimensional stress space. These requirements are derived in terms of non-intersecting conditions for asymptotes and an asymptotic plane. To demonstrate the validity of this approach, closed failure surfaces were derived for two graphite/epoxy material systems (3M SP288-T300 and IM7 8551-7). The agreement of test data with this model clearly shows that it is possible to use a higher order cubic failure theory with confidence. Author

# 25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*.

**N88-14159#** Swedish Inst. for Materials Testing, Boras.
**EXTINGUISHING DIFFUSION FLAMES WITH DRY POWDER AND HALON AT LOW FROUDE NUMBERS [STAECKNING AV GASDIFFUSIONSFLAMMOR MED PULVER OCH HALONER VID OLIKA FROUDES TAL]**
G. S. Holmstedt, H. Persson, and G. Saewemark [1986] 73 p In SWEDISH
(PB87-111365; SP-RAPP-1986-24; ISBN-91-7848-018-3) Avail: NTIS HC E04/MF E01 CSCL 21B

The object of the work was to study the interaction of dry powder and halon with turbulent diffusion flames at low Froude numbers in order to elucidate the physiochemical mechanisms responsible for flame suppression and extinguishment. Author

**N88-14160#** Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
**EFFECTS OF HYDROLYSIS ON METALLO-ORGANIC SOLUTION DEPOSITION OF PZT FILMS**
R. A. Lipeles, D. J. Coleman, and M. S. Leung 30 Oct. 1986 18 p
(ATR-86(8443)-1) Avail: NTIS HC A03/MF A01

The effects of hydrolysis on the degree of polymerization during metallo-organic solution deposition of lead zirconate titanate (PZT) films have been investigated. The reaction of lead 2-ethylhexanoate, zirconium n-tetrapropoxide, and titanium tetrabutoxide in isopropanol with water were studied using thermogravimetry, specular reflectance Fourier transform infrared spectroscopy (FTIR), and optical and electron microscopy. Films prepared from coating solutions having varying amounts of water exhibited dramatic differences in morphology. The films were spin-coated on platinum-coated fused silica substrates and annealed at 525 C for 30 minutes. Unhydrolyzed coating solutions and solutions with a mole ratio of water to total metal of 0.5 yielded perovskite films with 0.5 to 5 micron grains. A mole ratio of 1.5 (the amount of water required to completely hydrolyze the metallo-organics in the solution) formed amorphous, porous films. The stability of the prepolymerized films inhibits crystallization and densification at moderate temperatures. Author

**N88-14161#** Mound Lab., Miamisburg, Ohio.
**METHOD FOR PREPARING HYDRIDE CONFIGURATIONS AND REACTIVE METAL SURFACES Patent Application**
G. L. Silver, inventor (to DOE) 28 Nov. 1986 24 p
(Contract DE-AC04-76DP-00053)
(DE88-000845; US-Patent-Appl-SN-935981) Avail: NTIS HC A03/MF A01

Disclosed is a method for preparing highly hydrogen-reactive surfaces on metals which normally require substantial heating, high pressures, or an extended induction period. The method involves pretreatment of surfaces with either a nonoxidizing acid or hydrogen gas to form a hydrogen-bearing coating. The coated metal is heated in the absence of moisture and oxygen for a period sufficient to decompose the coating, and then cooled to room temperature. Surfaces so treated will react almost instantaneously with hydrogen gas at room temperature and low pressure. The method is particularly applicable to uranium, thorium, and lanthanide metals. DOE

**N88-14162#** Oak Ridge National Lab., Tenn.
**PROCESS FOR PREPARING TRANSITION METAL NITRIDES AND TRANSITION METAL CARBONITRIDES AND THEIR REACTION INTERMEDIATES Patent Application**
L. Maya, inventor (to DOE) Dec. 1986 10 p
(Contract DE-AC05-84OR-21400)
(DE88-000849; US-Patent-Appl-SN-939920) Avail: NTIS HC A02/MF A01

Disclosed is a process for making ammonolytic precursors to nitride and carbonitride ceramics. Extreme reaction conditions are not required and the precursor is a powder-like substance that produces ceramics of improved purity and morphology upon pyrolysis. DOE

**N88-14163#** Tennessee Univ., Knoxville.
**AREA DETECTORS FOR X-RAY SPECTROSCOPY**
T. A. Callcott, King-Long Tsang, Cheng Heng Zhang, D. L. Ederer, and E. T. Arakawa (Oak Ridge National Lab., Tenn.) Jun. 1987 28 p Presented at the 5th National Synchrotron Radiation Instrumentation Conference, Madison, Wisc., 21 Jun. 1987 Prepared in cooperation with Tennessee Univ., Knoxville; National Bureau of Standards, Washington, DC
(Contract DE-AC05-84OR-21400)
(DE88-001429; CONF-870610-13) Avail: NTIS HC A03/MF A01

Area detectors greatly increase the efficiency of data acquisition in spectroscopic applications. The operating principles, advantages and limitations of two types of detector systems are described. They are the microchannel plate (MCP) with resistive anode

readout, and the silicon charged-coupled-device (CCD), both with and without MCP enhancement. The linearity, size, resolution, quantum efficiency, noise specifications, stability, and uniformity of response are discussed. Data acquisition electronics are described briefly. The use of the devices is illustrated with applications to electron and soft X-ray spectroscopy. DOE

**N88-14164#** Pittsburgh Univ., Pa. Dept. of Chemistry.
**STUDY OF INTERACTIONAL EFFECTS IN THE CHEMISORBED LAYER BY INFRARED REFLECTION ABSORPTION SPECTROSCOPY (IRAS) Progress Report, 1 Apr. 1986 - 31 Mar. 1987**
J. T. Yates, Jr. Oct. 1987 25 p
(Contract DE-AC02-82ER-13017)
(DE88-001808; DOE/ER-13017/4) Avail: NTIS HC A03/MF A01

The IRAS (Infrared Reflection Absorption Spectroscopy) method has been applied to the study of CO adsorption on Ni(111). Evidence has been found for the coexistence of two-fold and three-fold coordinated CO species at low CO coverages. A continuous coverage-dependent conversion from three-fold to two-fold bridged CO has been observed. Accurate correlation of the development of the IRAS spectra with CO coverage, with CO temperature programmed desorption behavior, and with LEED behavior has been established through studies of the frequency and lineshape of the spectral features. Evidence for inhomogeneous CO layers at the highest CO coverages was obtained. This work establishes baseline behavior for other IRAS studies of this system to be reported. DOE

**N88-14165#** Sandia National Labs., Albuquerque, N. Mex.
**SUMMARY OF DISCUSSIONS AT THE NINTH MEETING OF THE SANDIA COOPERATIVE GROUP ON THE AEROTHERMOCHEMISTRY OF TURBULENT COMBUSTION**
R. W. Dibble and R. P. Lucht Oct. 1987 45 p Meeting held in Davis, Calif., 21-22 Apr. 1987
(Contract DE-AC04-76DR-00789)
(DE88-002281; SAND-87-8240) Avail: NTIS HC A03/MF A01

A turbulent reacting flow working group has been established through the Department of Energy/Office of Basic Energy Sciences. The purpose of this group is to establish and maintain a strong interaction and active dialogue between workers currently involved in modeling turbulent reacting flows and those involved in related experiments. One objective of this collaboration is to develop an increased understanding of the fundamental interaction between the chemical and fluid dynamical processes occurring in chemically reacting flows and to utilize this understanding to improve predictive capabilities for turbulent combustion. Regular members, who represent academia, private industry, and national laboratories, and guests participate in the meetings. Several guests are invited to each meeting to provide an influx of different ideas and opinions to the discussions. This document is a summary of the discussions that took place during the ninth meeting, which was held at UC Davis, California, April 21 and 22, 1987. DOE

**N88-14166** California Inst. of Tech., Pasadena.
**LONGITUDINAL MODE COMBUSTION INSTABILITIES IN AIR BREATHING ENGINES Ph.D. Thesis**
James David Sterling [1987] 708 p
Avail: Univ. Microfilms Order No. DA8719708

An investigation of the self-excitation of low frequency (100 to 600 Hz), longitudinal acoustic modes of a rearward-facing step combustor was performed. A series of parametric studies was performed to determine the dependence of the vortex shedding frequency upon the step height, mean flow speed, fuel type and equivalence ratio. It was discovered that the vortex shedding frequency can shift between modes as a result of changes in the chemical reaction time of the reactants or as a result of changes in the mixing process of the cold reactants with the hot products. Detailed investigations into the mechanisms of sustenance of the oscillations during instability were performed for several operating conditions. Dissert. Abstr.

**N88-14167#** Netherlands Energy Research Foundation, Petten.
**CHARACTERIZATION OF THE DIMENSIONS OF COLLOIDAL CALCIUM CARBONATE DISPERSIONS IN TOLUENE WITH NEUTRON SMALL-ANGLE SCATTERING**
W. A. H. M. Vlak, K. Mortensen, and J. Dorrepaal (Koninklijke/Shell-Lab., Amsterdam, Netherlands ) Feb. 1987 17 p
(ECN-197; B8703733; ETN-88-91351) Avail: NTIS HC A03/MF A01

Calcium carbonate particles, stabilized by a surface layer, and dispersed in toluene are investigated with neutron small-angle scattering. The dimensions of the core particle and the layer are estimated. Layer thickness is 8.6 (6) A, and the core particle radius is 16.5 (1.2) A. The limits within which these results are valid are indicated. ESA

**N88-14168#** Army Cold Regions Research and Engineering Lab., Hanover, N.H.
**GEOCHEMISTRY OF FREEZING BRINES, LOW-TEMPERATURE PROPERTIES OF SODIUM CHLORIDE**
Valerie L. Thurmond and Garrett W. Brass Aug. 1987 16 p
(AD-A185751; CRREL-87-13) Avail: NTIS HC A03/MF A01 CSCL 08C

Thermodynamic properties of electrolyte solutions change rapidly below 25 C, but these properties are seldom measured over the low temperature range (below 0 C), even though some salt solutions can remain unfrozen to -50 C. The heat capacities of concentrated solutions (0.5 to 0.6 molal) of NaCl-H2O were measured from 25 C to -40 C as part of a study to provide thermodynamic data of salt solutions for use in cold regions chemical and geophyscial studies. A differential scanning calorimeter was used to measure specific heat capacity from cooling scans as a function of temperature and concentration. The heat capacity data were fit to the equations of Pitzer and coworkers to obtain activity and osmotic coefficients of NaCl and H2O, respectively, below 0 C. Supercooling of the solutions was encouraged by using a fast scan rate so that specific heat could be measured to lower temperatures than would be possible if the solutions were allowed to equilibrate with the solid phases. The solubility of ice was calculated and compared to the experiment freezing point of NaCl solutions. GRA

**N88-14169#** Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
**MIXING AND COMBUSTION OF PULSED GAS JETS Semiannual Report, Jul. - Dec. 1986**
S. R. Turns, C. L. Merkle, J. A. Lovett, and A. Hosangadi Jan. 1987 56 p
(Contract GRI-5086-260-1308)
(PB88-112834; PSU-ME-R-86/87-0018; GRI-87/0273) Avail: NTIS HC A04/MF A01 CSCL 21B

To provide understanding of the mixing processes and combustion in pulsed jets, the research aims to characterize the detailed structure of pulsed gas-air diffusion flames experimentally and analytically. Primary accomplishment during the period was the design and fabrication of an experimental facility that would allow study over a wide range of Reynolds numbers, Strouhal numbers, and pulse strengths. Preliminary results show that pulsing significantly enhances the lift-off stability of the flames over the range of frequencies and Reynolds numbers studied. GRA

**N88-14170#** Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
**MIXING AND COMBUSTION OF PULSED GAS JETS Semiannual Report, Jan. - Jun. 1987**
S. R. Turns, C. L. Merkle, J. A. Lovett, and A. Hosangadi Jul. 1987 46 p
(Contract GRI-5086-260-1308)
(PB88-108014; PSU-ME-R-87/88-0004; GRI-87/0274) Avail: NTIS HC A03/MF A01 CSCL 21B

Continuing work on the research to characterize the detailed structure of pulsed gas-air diffusion flames experimentally and analytically involved gathering of additional data on flame lengths

and lift-off stability. Although flame lengths appear to be controlled by pulse strength independent of frequency, the strongest coupling between the flame and source pulse appears at far-field Strouhal numbers of approximately 0.3. Based on high-speed cine and phase-locked still photographs of flames, the initial increase in flame length with pulse strength appears to be due to the suppression of naturally occurring helical mode mixing in favor of axisymmetric modes which become more efficient as pulse strength is increased further. GRA

**N88-14131#** Joint Publications Research Service, Arlington, Va.
**GAS SEPARATION USING SOLID ELECTROLYTES DESCRIBED**
Hiroyasu Iwahara *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 1-14 Transl. into ENGLISH from Kino Zairyo (Tokyo, Japan), Mar. 1987 p 5-12 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

# 26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

**N88-14171#** Oak Ridge National Lab., Tenn.
**BASIC ENERGY SCIENCES RESEARCH IN THE METALS AND CERAMICS DIVISION OF OAK RIDGE NATIONAL LABORATORY**
E. E. Bloom 1987 28 p Presented at the Materials Sciences Subcommittee of the Basic Energy Sciences Advisory Committee Meeting, Argonne, Ill., 6 Aug. 1987
(Contract DE-AC05-84OR-21400)
(DE87-013538; CONF-8708161-1-Vugraphs) Avail: NTIS HC A03/MF A01

The role of boron in Ni3Al was investigated. Microalloying with boron improved the tensile ductility and suppressed brittle grain boundary fracture. When the Al content was increased from 24 to 25 percent, ductility decreased and fracture increased in alloys doped with 0.2 percent boron. Fracture and strain in Al2O3, near surface mechanical and physical properties, and microstructure of ion-implanted sapphire were also investigated. Increasing the toughness of the matrix of Al2O3 by whisker toughening with transformation toughening resulted in a product tougher than the toughening mechanisms. The hardness of amorphous Al2O3 was 20 percent of the crystalline value, while the elastic modulus was 40 percent. DOE

**N88-14172#** Materials Engineering Associates, Inc., Lanham, Md.
**FRACTOGRAPHIC AND MICROSTRUCTURAL ASPECTS OF FRACTURE TOUGHNESS TESTING IN IRRADIATED 304 STAINLESS STEEL**
W. H. Cullen, A. L. Hiser, J. R. Hawthorne, G. A. Abramczyk, and G. R. Caskey 1987 32 p Presented at the Symposium on Technology of Glass, Ceramic, or Glass-Ceramic to Metal Sealing, Boston, Mass., 13 Dec. 1987 Prepared in cooperation with E. I. DuPont de Nemours and Co., Aiken, S.C.
(Contract DE-AC09-76SR-00001)
(DE88-000795; DP-MS-87-91; CONF-871207-19; MEA-2245)
Avail: NTIS HC A03/MF A01

Fracture toughness and Charpy impact test results on 304 stainless steel baseplate, weld and heat-affected zone (HAZ) tested at 25°C and 125°C are correlated with the microstructural and fractographic features observed in these materials. Specimens were collected from several sections of 12.7 mm (0.5 in.) wall thickness piping removed from a process system, and were characterized by different material chemistries and thermomechanical histories. As a result, mechanical properties vary over a considerable range from one pipe section to another. The presence of delta ferrite in some of the samples caused significant degradations in the toughness properties for certain crack orientations. Decreases in Charpy impact energies occur in the same material for different crack orientations. Materials irradiated showed 40 percent decreases in Charpy impact energy, but little change in fracture morphology. An increase in the test temperature resulted in an expected increase in Charpy energies for all materials. Fractographic features did not change appreciably with respect to the 100°C increase in test temperature. In unirradiated specimens, a test temperature increase caused lower J sub Ic and J-R curve values with tearing modules values increased. The latter is due to the large decreases in tensile strength with increasing test temperature. The weld metals tend to have the highest tearing resistance, while the HAZ's tend to have the lowest. DOE

**N88-14173#** California Univ., Berkeley. Lawrence Berkeley Lab.
**FRACTURE ANALYSIS OF DRAWN COMPOSITE DUAL-PHASE STEEL WIRE**
L. Sidjanin, S. Miyasato, and G. Thomas Jul. 1987 18 p Presented at the Interwire Conference, Atlanta, Ga., 25 Oct. 1987
(Contract DE-AC03-76SF-00098)
(DE88-001396; LBL-23250; CONF-8710176-1) Avail: NTIS HC A03/MF A01

The Fe2Si0.1 dual-phase steel was studied with composition 0.08 C, 1.9 Si, 0.32 Mn, 0.004 P, 0.004 S (wt percent) to develop the dual-phase structure with various morphologies. Thermal and control rolling thermomechanical processing were used. Treated samples were machined to 5.5 mm diameter and then drawn without coating in a hand operated drawing machine. The microstructures of longitudinal sections before and after deformation were assessed by light optical and scanning electron microscopy (SEM). Void density measurements were performed by SEM at 2000X. A linear relationship was found between true strain and void density after wire drawing low carbon duel-phase steels for all morphologies studied. Void formation was found to begin either by decohesion of the ferrite/martensite interface, or by shear microcracking of the martensite particles. The formation of voids during wire drawing can be correlated with differences in martensite morphology and martensite/ferrite interface coherency. A fibrous distribution of 20 percent lath martensite in fine-grained ferrite appears to be the most promising composite to obtain high strength ductile wire, e.g., for tire cord application and hence FeSiC rather than FeMnC steels are preferred. DOE

**N88-14174#** Oak Ridge National Lab., Tenn.
**SINGULARITIES IN X-RAY SPECTRA OF METALS**
G. D. Mahan Aug. 1987 24 p Presented at the Tsukuba Institute on the Fermi Surface Effect, Tsukuba, Japan, 1 Aug. 1987 Prepared in cooperation with Tennessee Univ., Knoxville
(Contract DE-AC05-84OR-21400)
(DE88-001440; CONF-8708160-1) Avail: NTIS HC A03/MF A01

The X-ray spectroscopies discussed are absorption, emission, and photoemission. The singularities show up in each of them in a different manner. In absorption and emission they show up as power law singularities at the thresholds frequencies. This review will emphasize two themes. First a simple model is proposed to describe this phenomena, which is now called the MND model after Mahan-Nozieres-DeDominicis. Exact analytical solutions are now available for this model for the three spectroscopies discussed above. These analytical models can be evaluated numerically in a simple way. The second theme of this review is that great care must be used when comparing the theory to experiment. A number of factors influence the edge shapes in X-ray spectroscopy. The edge singularities play an important role, and are observed in many matals. Quantitative fits of the theory to experiment require the consideration of other factors. DOE

**N88-14175#** Los Alamos National Lab., N. Mex.
**AN OVERVIEW OF METAL PLASTICITY**
D. L. Preston Oct. 1987 38 p
(Contract W-7405-eng-36)
(DE88-001658; LA-11084-MS) Avail: NTIS HC A03/MF A01

This report mathematically describes plastic flow in metals. A review of single crystal and polycrystal plasticity is included to

add comprehensiveness and to give the reader some physical understanding of plastic flow in commercially available metal. Because certain flow problems are best formulated in coordinate systems that reflect a basic symmetry in the flow, a derivation was included of the generally invariant thermoelastic-plastic flow equations, which are applied to the specific example of spherically symmetric flow. DOE

**N88-14176#** Oak Ridge National Lab., Tenn.
**THE EFFECT OF NEUTRON IRRADIATION ON THE TENSILE PROPERTIES AND MICROSTRUCTURE OF SEVERAL VANADIUM ALLOYS**
D. N. Braski 1987 21 p Presented at the US/USSR Fusion Materials Workshop, Oak Ridge, Tenn., 31 Aug. 1987
(Contract DE-AC05-84OR-21400)
(DE88-001755; CONF-8708138-3-Vugraphs) Avail: NTIS HC A03/MF A01

This paper contains viewgraphs describing the effects of neutron irradiation on the tensile properties and microstructure of vanadium alloys in first wall fusion reactors. A tritium trick experiment was used to study the helium embrittlement and the stresses and strains on these materials in a controlled environment. DOE

**N88-14177#** Oak Ridge National Lab., Tenn.
**SWELLING BEHAVIOR OF FERRITIC/MARTENSITIC STEELS**
P. J. Maziasz and R. L. Klueh 1987 25 p Presented at the US/USSR Fusion Materials Workshop, Oak Ridge, Tenn., 31 Aug. 1987
(Contract DE-AC05-84OR-21400)
(DE88-001757; CONF-8708138-4-Vugraphs) Avail: NTIS HC A03/MF A01

The 9Cr and 12Cr martensitic/ferritic steels are candidate first wall and blanket materials for application in magnetic fusion energy systems. This paper contains viewgraphs reviewing the attractive properties and the problems associated with using these steels as first wall materials. DOE

**N88-14178#** Sandia National Labs., Albuquerque, N. Mex.
**SURFACE GOUGING BY HYPERVELOCITY SLIDING CONTACT BETWEEN METALLIC MATERIALS**
L. M. Barker, T. G. Trucano, and J. W. Munford Sep. 1987 44 p
(Contract DE-AC04-76DP-00789)
(DE88-001937; SAND-87-1328) Avail: NTIS HC A03/MF A01

Surface gouging due to hypervelocity sliding contact has been observed for many years above certain threshold velocities in hypervelocity gun barrels and on the rails of rocket-propelled sleds. To aid in understanding the environment of the gouging event, some order-of-magnitude calculations of pertinent temperatures, pressures, energies, times, distances are presented. The calculations of the gouging environment, together with a review of current and published observations of gouging, including metallurgical studies of gouges, leads to a hypothesis for the mechanism of gouging damage. The hypothesis is tested by computer simulation of the dynamic gouge initiation and growth phases. In addition to agreeing with experimental observations, parameter variations in the computer simulations pointed out design concepts which should result in gouge-mitigating shoes for rocket sleds. The successful results of the first test of such sled shoes are presented. DOE

**N88-14179*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ION-BEAM NITRIDING OF STEELS Patent**
Joshua Salik, inventor (to NASA) and Theodore E. Hubbell, inventor (to NASA) 3 Nov. 1987 7 p Filed 29 Jan. 1986 Supersedes N86-32556 (24 - 24, p 3708) Continuation-in-part of US-Patent-Appl-SN-661481, filed 16 Oct. 1984, abandoned
(NASA-Case-LEW-14104-2; US-Patent-4,704,168; US-Patent-Appl-SN-823713; US-Patent-Class-148-16.6; US-Patent-Class-204-192.31; US-Patent-Class-427-38; US-Patent-Appl-SN-661481) Avail: US Patent and Trademark Office CSCL 11F

A surface of a steel substrate is nitrided without external heating by exposing it to a beam of nitrogen ions under low pressure, a pressure much lower than that employed for ion-nitriding. An ion source is used instead of a glow discharge. Both of these features reduce the introduction of impurities into the substrate surface.
Official Gazette of the U.S. Patent and Trademark Office

**N88-14180*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**MICROSTRUCTURES IN RAPIDLY SOLIDIFIED NIOBIUM ALUMINIDES**
Mohan G. Hebsur (Sverdrup Technology, Inc., Cleveland, Ohio.) and Ivan E. Locci 1988 17 p Proposed for presentation at the 2nd International Conference on Rapidly Solidified Materials, San Diego, Calif., 7-10 Mar. 1988; sponsored by the American Society for Metals
(NASA-TM-100264; E-3894; NAS 1.15:100264) Avail: NTIS HC A03/MF A01 CSCL 11F

Niobium alloys are potential candidates for advanced aerospace applications due to their favorable combination of density and other high-temperature properties. However, niobium alloys require improved oxidation resistance. NASA Lewis has initiated a program to investigate oxidation resistant Nb-alloys based on Al2O3 scale forming composition. Of the Nb-Al intermetallics, NbAl3 is the most oxidation resistant; however, it is very brittle and weak. The microstructures of niobium aluminides produced by conventional casting as well as chill block melt spinning were investigated. Ternary alloys containing Cr and Ti were rapidly solidified by melt spinning in an argon atmosphere. The melt spun ribbons were examined by optical, X-ray, and TEM techniques. Microstructures range from single phase for Nb-75 at percent Al (NbAl3) to two phase for Nb-46 at percent Al (NbAl3 + Nb2Al). Ternary alloys tend to form a complex intermetallic phase along the grain boundaries. Details of the microstructural investigation are presented. Author

**N88-14181#** Societe Nationale Industrielle Aerospatiale, Suresnes (France). Direction Centrale de la Qualite.
**STUDY OF SURFACE TREATMENT BEFORE BONDING OF LIGHT ALLOYS Test Report [ETUDE DES TRAITEMENTS DE SURFACE AVANT COLLAGE DES ALLIAGES LEGERS]**
J. Odorico, J. M. Cuntz, and M. Villatte 10 Mar. 1987 64 p In FRENCH
(Contract DRET-85-34-444)
(DCQ/L-48-287/F; ETN-88-91173) Avail: NTIS HC A04/MF A01

The mechanical behavior of aluminum alloy bonded junctions such as those employed in aircraft structures was related to previous surface treatment. The treatment consists of phosphoric medium anodizing. The effects of time, heat, and moisture were studied, showing that 48 hr in dry atmosphere does not affect bonding characteristics, while a hot and humid medium significantly affects the physical and chemical characteristics of the surface layer as well as the resulting mechanical properties of the bonded joints. ESA

**N88-14182#** Centro Informazioni Studi Esperienze, Milan (Italy).
**MONITORING CORROSION AND PROCESS PHYSICAL-CHEMICAL PARAMETERS IN ELECTRIC POWER PLANTS [MONITORAGGIO DELLA CORROSIONE E DEI PARAMETRI CHIMICO-FISICI DI PROCESSO IN IMPIANTI TERMOELLETTRICI]**
G. Buzzanca and R. Pascali 1987 26 p In ITALIAN Presented at Giornata di Studio ATI-AIPnD: Diagnostica Automatizzata o non degli Impianti Termici, Milan, Italy, 29 Apr. 1987
(CISE-3708; ETN-88-91297) Avail: NTIS HC A03/MF A01

Corrosion monitoring sensors and monitoring systems are described. The controlled parameters include redox potential, specific conductivity, corrosion, and pH. The pH sensor is implemented with an Zn-Yt membrane. Sensors are designed to work in a 300 C 100 bar environment. The development of the corrosion sensor, which is based on the measurement of linear

field polarization resistance, is outlined. Results of 5yr monitoring are presented. ESA

**N88-14183#** Council for Mineral Technology, Randburg (South Africa).
**DETERMINATION, BY X-RAY FLUORESCENCE, OF PLATINUM, PALLADIUM, RUTHENIUM, IRON AND CHROMIUM IN SPECIAL STEELS**
B. T. Eddy 29 Aug. 1986 31 p
(PB87-132114; MINTEK-M269; ISBN-0-86999-761-0) Avail: Issuing Activity CSCL 11F

The report describes the analysis of special corrosion-resistant steels for ruthenium, palladium, and platinum by X-ray fluorescence spectrometry (XRFS) and a thin-film technique. The precision of the method varies from 1 to 7 percent, depending upon the analyte and its concentrations. The accuracy is good and compares favorably with that of other methods. The direct determination of these elements on solid samples with the use of scattered radiation as a matrix correction is only partly successful and is not recommended. The three platinum-group elements, iron, and chromium can be determined successfully in solid samples by XRFS if an empirical interelement correction method is used. The correction factors are determined by a multiple-regression method. The precision of the determination of the platinum-group elements is about 1 percent and that of iron and chromium about 0.2 percent. The accuracy is in most cases better than 2 percent for all the elements determined. The method can be implemented with the use of available computer software and a small microcomputer. The two recommended laboratory methods are given as appendices to the report. GRA

**N88-14184#** Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Chemical Engineering.
**UNDERCOOLING AND NUCLEATION IN IRON NICKEL ALLOYS**
Don H. Rasmussen and Kazi Javed 1986 18 p
(Contract DAAG29-85-K-0196)
(AD-A185500; ARO-22779.1-MS) Avail: NTIS HC A03/MF A01 CSCL 07D

Pure iron, pure nickel and iron nickel alloys have been undercooled a maximum of 0.25 tm (actual maximum observed undercoolings varied from 440 degrees for pure iron to 420 degrees for a 58 w/o nickel alloy). The dispersion of the preformed and surface treated metal powders in a ceramic matrix has permitted control of the droplet undercooling through surface chemistry. Even though this undercooling exceeds the classical 0.2 Tm level for homogeneous nucleation, the nucleation event is not likely to be homogeneous in origin because of the importance of droplet surface chemistry on determining the undercooling. The temperature of nucleation mirrors the liquid's curve in composition dependence. This behavior is explained with a thermodynamic model of nucleation in regular solutions. GRA

**N88-14185#** Army Lab. Command, Watertown, Mass. Material Technology Lab.
**THE EFFECT OF ION IMPLANTATION ON THE CORROSION BEHAVIOR OF A HIGH-DENSITY SINTERED TUNGSTEN ALLOY**
Frank C. Chang, Milton Levy, and Sin-Shong Lin Aug. 1987 17 p
(AD-A185713; MTL-TR-87-38) Avail: NTIS HC A03/MF A01 CSCL 11F

The effect of Chromium, Nickel, Tantalum, and Titanium ion implantation on the electrochemical corrosion behavior of a high density sintered tungsten alloy has been investigated in Chlorine ion-free and Chlorine ion containing aqueous solution buffered to pH values of 4, 9, and 12. A three sweep potentiodynamic polarization technique was used to compare the polarization behavior of unimplanted and implanted surfaces. The surfaces of the ion-implanted tungsten alloy were characterized by Auger electron spectroscopic (AES) analysis. GRA

**N88-14132#** Joint Publications Research Service, Arlington, Va.
**NEW APPLICATION OF TRANSITION METAL CARBIDES DETAILED**
Yoshio Ishizawa *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 15-25 Transl. into ENGLISH from Kino Zairyo (Tokyo, Japan), Mar. 1987 p 13-20 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

**N88-14757#** Joint Publications Research Service, Arlington, Va.
**STUDIES OF TUNNELING IN METALS UNDER HIGH PRESSURE Abstract Only**
V. M. Svistunov, M. A. Belogolovskiy, and O. I. Chernyak *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 51-52 Transl. into ENGLISH from Uspekhi Fizicheskikh Nauk (Moscow, USSR), v. 151, no. 1, Jan. 1987 p 31-66 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

# 27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

For composite materials see *24 Composite Materials.*

**N88-14186#** Institut National de Recherche Chemique Applique, Vert le Petit (France).
**HIGH TEMPERATURE ADHESIVE Final Report [ADHESIF HAUTE TEMPERATURE]**
R. Vuichard, J. P. Cassin, and S. Bertrand Feb. 1986 33 p In FRENCH Sponsored by Direction des Recherches, Etudes et Techniques, Paris (France)
(PB87-109229; IRCHA/A-9302) AVAIL: NTIS HC E04/MF E04 CSCL 11A

A polyimide adhesive film for use at high temperatures equal to or higher than 250 C is discussed. A pilot plant for making the film from polyimide resin and transferring it onto glass fabric has been completed. Pictures of the film-making and transfer units along with some details of the process are included. The film's adhesion and thermal resistance properties are superior to other adhesives of similar type. Long term thermal stability studies are in process and would form the subject of a supplementary report. Figures available now show good thermal stability at 250 C. Other physical properties and test results are given. Author

**N88-14187#** Swedish Inst. for Materials Testing, Boras.
**TMA-MICRORHEOLOGICAL TESTING OF POLYMERS (THERMOMECHANICAL ANALYSIS)**
J. Hetenyi, C. Lagerquist, and B. Sjoeblom 1987 63 p
(PB87-228805; SP-RAPP-1987:17; ISBN-91-7848-058-2) Avail: NTIS HC A04/MF A01 CSCL 07B

The TMA-micro-rheological testing provides a sensitive method for determining rheological behavior of polymer in transit and molten state by measuring the forming properties as a function of temperature, load, and time. For the important rheological properties very small amounts of material, 5 to 30 mg are used. Data may be used for quality control, research, development, and establishment of processing condition. It also serves as a guide in the selection of materials for application. GRA

**N88-14188#** National Materials Advisory Board, Washington, D.C.
**CERAMIC TECHNOLOGY FOR ADVANCED HEAT ENGINES Final Report**
Jul. 1987 73 p Sponsored by DOE, Washington, D.C.
(PB87-232997; NMAB-431) Avail: NTIS HC A04/MF A01 CSCL 07B

Application of the increasing base of fundamental knowledge and research tools to develop improved processes for cost-effective ceramic materials with improved reliability and performance

characteristics is the goal of the Department of Energy. A committee appointed to review the program assessed the objectives, balance, and priorities. Emerging opportunities were identified, an international exchange agreement was examined, and the mechanisms of technology transfer were investigated. Coordination efforts were studied, and the technical planning for the program was critiqued. It is believed that many but not all of the most important components of the basic ceramic technologies relating to improved performance and reliability are being addressed. Although individual projects were not examined in detail, it was felt that the general quality of the technical work is good. The committee is less certain that progress is being made in bringing these components together into a technically successful process for producing final ceramic products with significantly improved reliability and performance. Also, little evidence is found that substantial progress toward cost effective processing is being made. Indeed, there appears to be no organized attempt to do cost analysis. GRA

**N88-14189#** Institut Rudjer Boskovic, Zagreb (Yugoslavia).
**DEVELOPMENT OF STRENGTH IN CEMENTS Interim Report, Sep. 1985-1986**
B. Matkovic, T. Gaseca, P. Zizic, and J. F. Young Apr. 1987 65 p Sponsored by Federal Highway Administration, Washington, D.C. and Yugoslav Joint Board on Scientific and Technological Cooperation, Belgrade
(PB87-232971; FHWA/RD-87/028) Avail: NTIS HC A04/MF A01 CSCL 20K

Part 1 deals with dicalcium silicates doped by phosphates; describing formation, composition, and development of the reaction products and strength. Part 2 describes how BCa2SiO4 can be obtained from a mixture of CaC2O4 H2O and amorphous silica by firing at 950 C, as opposed to a normal sintering temperature around 1450 C. Part 3 discusses the greatly improved strength of belite clinker achieved when the combined addition of expansive clinker C4A3S and gypsum accompanied the use of silica fume and superplasticizer. Part 4 is concerned with the possibility of utilizing some unconventional fuels as substitutes for fuel oil or gas in the cement industry. GRA

**N88-14190#** Brookhaven National Lab., Upton, N. Y.
**IONICALLY CONDUCTING POLYMERS: PRINCIPLES AND PROPERTIES OF SOLID ELECTROLYTES**
T. Skotheim and Y. Okamoto 1987 21 p Presented at the Short Course on Electroactive Polymers, New Platz, N.Y., 28 oct. 1987 Prepared in cooperation with Polytechnic Univ., Brooklyn, N.Y.
(Contract DE-AC02-76CH-00016)
(DE88-001552; BNL-40320; CONF-8710178-1) Avail: NTIS HC A03/MF A01

The recent success in developing rechargeable lithium batteries incorporating polyether-based electrolytes has led to the anticipation of a wider use of polymer electrolytes in a host of different applications. The polymers with the best combinations of solbation power, conductivity and electrochemical stability are all based on either PEO or polymers inccrporating a high density of EO units. PEO-based electrolytes still yield the highest conductivities at elevated temperatures (approx. 100C) when it is completely amorphous. What has emerged during the last ten years of research on polymer electrolytes is the central importance of the amorphous state for high conductivity, where the ion mobility is governed by the mobility associated with a low glass transition temperature. The difference between polymer and liquid electrolytes is that in the former the solvating part does not migrate with the ions. There is, however, still some controversy concerning the nature of the ionic species, i.e., whether the salt is present in the form of associated ions. The intensive research of the last few years has led to a far better understanding of these polymer-ion complexes. Several different types of solvating polymers have been developed, in particular single ion conductors, which represent much of the future of ion conducting polymer research. DOE

**N88-14191#** Joint Publications Research Service, Arlington, Va.
**JPRS REPORT: SCIENCE AND TECHNOLOGY. JAPAN**
16 Jul. 1987 103 p Transl. into ENGLISH from various Japanese articles
(JPRS-JST-87-023) Avail: NTIS HC A06/MF A01

Topics addressed in science and technology include: advanced materials; marine technology; science and technology policy; defense industries; and telecommunications. For individual titles, see N88-14192 through N88-14193.

**N88-14192#** Joint Publications Research Service, Arlington, Va.
**DEVELOPMENTS IN ELECTRONICS CERAMICS REPORTED**
Hirotoshi Shibata *In its* JPRS Report: Science and Technology. Japan 16 Jul. 1987 p 2-8 Translated into ENGLISH from Nikko Materials (Tokyo, Japan), Jan. 1987 p 26-29 (For primary document see N88-14191 06-27)
Avail: NTIS HC A06/MF A01

Ceramics, which are used in various solid devices, have performed an important part in the development of the electronics industry. The development of these devices known generically as electronic ceramics can be said to be the basis for the development of the electronics industry even at the present; its importance, therefore, has become even greater. An epoch making piezoelectric actuator, one of the electronic ceramics, was developed. This is an actuator which develops a bending phenomenon, though it consists of one ceramic sheet, and is said to have merits in terms of price and quality, compared with the existing actuators. It is not an exaggeration to say that it is one of the electronic ceramics attracting a great deal of public attention. Mention will be made of the present condition of the electronic ceramics, centering on the piezoelectric actuators. Author

**N88-14193#** Joint Publications Research Service, Arlington, Va.
**RECORDING MATERIALS FOR OPTICAL DISK MEMORY DISCUSSED** **c35**
Tsutomu Ueno *In its* JPRS Report: Science and Technology. Japan 16 Jul. 1987 p 9-24 Transl. into ENGLISH from Ceramics Japan (Tokyo), Dec. 1986 p 1077-1083 (For primary document see N88-14191 06-27)
Avail: NTIS HC A06/MF A01

The outline on recording materials for optical disks of the postscript and rewrite types was presented. Considerable development is necessary for these recording materials to satisfy all demands on optical disks including factors such as large capacity, possibility of high-speed access, long life and economy, and the possibility is also high that newer recording principles and materials will turn up in the future. Therefore, the forecast on what sort of recording material the optical memory technology will be integrated is difficult to predict at the present stage. It is considered that the putting of recording materials to practical use by matching with the applications that are making the best use of the respective characteristics will progress in the future. Author

**N88-14194#** Sandia National Labs., Albuquerque, N. Mex.
**THE EFFECTIVE ELASTIC PROPERTIES OF LOW-DENSITY FOAMS**
W. E. Warren and A. M. Kraynik 1987 45 p Presented at the Symposium on Constitutive Modeling for Nontraditional Materials, Boston, Mass., 12 Dec. 1987
(Contract DE-AC04-76DP-00789)
(DE87-014629; SAND-87-0127C; CONF-871228-1) Avail: NTIS HC A03/MF A01

Theoretical micromechanical models for the elastic response of solid foams are developed. Idealized two-dimensional closed-cell foams are considered to be spatially periodic with either hexagonal or square network structure; while three-dimensional open-cell foams are assumed to be composed of randomly oriented tetrahedral or cubic elements. The thickness of films in two-dimensional foams and struts in three-dimensional foams is permitted to vary with distance from their mutual joints. The effective elastic constants are explicitly related to the compliances for bending and stretching of the individual films and struts. For small strains, bending is the primary distortional mechanism for

low-density foams whose structure is consistent with minimal surface area - hexagonal and tetrahedral structure. Two-dimensional foams with hexagonal structure and with linear elastic films exhibit nonlinear elastic response for large deformations; this stems from the increasing role of film stretching due to geometrical effects associated with large cell distortion. DOE

**N88-14195#** Sandia National Labs., Albuquerque, N. Mex.
**REACTIONS AND BONDING BETWEEN GLASSES AND TITANIUM**
R. K. Brow and R. D. Watkins Oct. 1987 22 p Presented at the Symposium on Technology of Glass, Ceramic, or Glass-Ceramic to Metal Sealing, Boston, Mass., 13 Dec. 1987
(Contract DE-AC04-76DP-00789)
(DE88-000603; SAND-87-0541C; CONF-871207-18) Avail: NTIS HC A03/MF A01

Hermetic seals between titanium and both silicate and alkaline earth boroaluminate glasses have been made. Mechanical testing of pin-seal configurations indicate that the boroaluminate glass seals are at least 50 percent stronger than the silicate glass seals. To explain these differences, the interfacial chemistries of the two systems were characterized by a number of techniques, including X-ray photoelectron spectroscopy (XPS). Titanium-silicide and titanium-boride phases were found, respectively, at the silicate- and boroaluminate-titanium interfaces. Thermochemical calculations were done to describe the redox conditions necessary to produce the interfacial reaction products. We find that the rapid development of a relatively thick silicide interfacial phase adversely affects the strength of a silicate glass-titanium seal, while the formation of a thinner boride phase does not affect the properties of the boroaluminate glass seals. DOE

**N88-14196#** Oak Ridge National Lab., Tenn.
**ELECTRON MICROSCOPY STUDIES OF TENSILE CYCLIC FATIGUE-TESTED SILICON NITRIDE CERAMICS**
L. F. Allard, T. A. Nolan, and K. C. Liu 1987 32 p Presented at the Department of Materials Science and Engineering Seminar, Ann Arbor, Mich., 19 Oct. 1987
(Contract DE-AC05-84OR-21400)
(DE88-001438; CONF-8710177-1-Vugraphs) Avail: NTIS HC A03/MF A01

Specimens of a commercial silicon nitride material, tested in tensile fast fracture and tensile-tensile cyclic fatigue at elevated temperatures, were examined to determine the failure mechanisms and the effects of the mechanical tests on the microstructure of the material. It is of interest to determine the extent to which the failures are controlled by macrodefects, rather than by microstructural phenomena. For these results, fracture surfaces were being characterized in detail utilizing both optical and low voltage scanning electron microscopy (SEM) techniques. General microstructures were characterized by both compositional backscattered SEM methods, and in greater detail by techniques of transmission electron microscopy (TEM). Tests at 1200 C indicated a strain-hardening behavior similar to that observed in metal alloys. Preliminary TEM results comparing the microstructural features of as-sintered material with those of specimens from this series are presented in the form of vugraphs. DOE

**N88-14197#** Lawrence Livermore National Lab., Calif.
**VISCOELASTIC PROPERTIES OF EA951 ADHESIVE: A SOURCE OF CREEP DEFORMATIONS OF A STRONGBACK**
W. W. Feng 28 Sep. 1987 18 p
(Contract W-7405-eng-48)
(DE88-001581; UCID-21194) Avail: NTIS HC A03/MF A01

Both creep and relaxation functions for EA951 adhesive are presented. During this study, we have found that the adhesive used in the bonding of the facing sheet and the NOMAX of a strongback crept from 0.6 percent of strain to 2 percent in about 10 days at room temperature. Other materials, such as F263 epoxy used in the strongbacks, did not creep at room temperature. Therefore, we concluded that the creep in strongbacks observed by Schauer was due to the adhesive. We then recommended that the EA951 adhesive be replaced with FM355 adhesive. The creep phenomenon for the new strongback, constructed with the new adhesive, was eliminated. DOE

**N88-14198#** Texas Univ., Austin. Dept. of Chemistry.
**PHOTOINDUCED CHARGE SEPARATION BY POLYMER-BOUND CHROMOPHORES Progress Report, Sep. 1986 - Oct. 1987**
S. E. Webber Oct. 1987 4 p
(Contract DE-FG05-86ER-13629)
(DE88-002101; DOE/ER-13629/1) Avail: NTIS HC A02/MF A01

Accomplishments during the first year are summarized in the following areas: preparation of photophysically active polymers, charge separation studies in polymers AACAA (A=hydrophilic group, C=aromatic chromophore), photoionization in polymers AACAA, and photon harvesting in ACACA polymers. DOE

**N88-14199#** California Univ., Berkeley. Lawrence Berkeley Lab.
**SINTERING AND DENSIFICATION OF PARTICULATE COMPOSITES: INCLUSION SIZE AND CLUSTERING Ph.D. Thesis**
M. W. Weiser Aug. 1987 71 p
(Contract DE-AC03-76SF-00098)
(DE88-002230; LBL-23800) Avail: NTIS HC A04/MF A01

Previously, attempts have been made to explain the lower densification rates observed in ceramic bodies containing inclusions in terms of hydrostatic back stresses that arise out of the matrix shrinking around the inclusion. These models can account for the observed dependence of the densification on the volume fraction of inclusions. However, they fail to account for the observed large differences in densification for inclusions of different sizes. It is proposed that the lower densification for smaller inclusions is a consequence of both a thin matrix layer at the inclusion's surface that densifies less readily than the bulk and the clustering that can occur more readily among smaller inclusions. The observed lower densification rates are a function of the volume fraction, size, degree of inclusion clustering, and the processing during powder mixing. These lower densification rates can be treated as the effective volume fraction of the second phase being greater than the volume fraction that is actually present. An experimental investigation was conducted on ZnO/SiC composite, with a computer simulation of clustering. DOE

**N88-14200#** Direction des Recherches Etudes et Techniques, Paris (France). Centre de Documentation de l'Armement.
**CYCLIC FATIGUE OF CERAMICS AT HIGH TEMPERATURES Final Report**
P. Vivier and M. Boussuge May 1986 54 p In FRENCH
(PB87-127700) Avail: NTIS HC E04/MF E04 CSCL 11B

An experimental four-point flexion device allowing monolithic cyclic fatigue tests has been achieved. It allows continuous measurement of the applied charge and of the sample deflection up to 1400 C and 200 Hz. The results obtained on natural fritted silicon carbide show that this material is particularly resistant to slow damaging at 1200 C, and deteriorates principally by slow fissurization. Author

**N88-14201*#** National Aeronautics and Space Administration, Washington, D.C.
**GLASSY GeO2 OBTAINED BY THE GEL PROCESS**
Bernd Voigt Nov. 1987 6 p Transl. into ENGLISH from Zeitschrift fuer Chemie (West Germany), v. 24, no. 4, 1984 p 143-144 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TT-20125; NAS 1.77:20125) Avail: NTIS HC A02/MF A01 CSCL 11B

A comparison is made between GeO2 glass produced by the gel process and by a combined gel and thermal process. The latter appears to be more effective. Author

**N88-14202*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**MECHANISTIC STUDIES OF POLYMERIC SAMPLES EXPOSED ABOARD STS 8**
Ranty H. Liang, Amitava Gupta, Shirley Y. Chung, and Keri L. Oda 15 Dec. 1987 37 p
(Contract NAS7-100)
(NASA-CR-182364; JPL-Pub-87-25; NAS 1.26:182364) Avail: NTIS HC A03/MF A01 CSCL 11C

The early Shuttle flights and the attendant opportunity to deploy material samples to the near-Earth space environment, along well-defined trajectories and accompanied by detailed characterization of these samples prior to and following the flight exposure, have brought to light several novel phenomena associated with interaction of these materials with the space environment. JPL, in coordination with other NASA Centers, has carried out a research program to study the degradation and oxidation processes caused by interaction of these materials with atomic oxygen at an energy of 5 eV. In addition, energetic atomic oxygen is believed to be responsible for the shuttle glow first observed during the flight of STS-3. The shuttle glow phenomenon has been extensively studied and modeled because of its long-range potential impact on optical communication schemes and its more immediate impact on the Space Telescope. This report summarizes the results of certian material degradation and erosion experiments carried out aboard STS-8 between August 30, 1983 and September 5, 1983. Based on these data, a generic degradation model has been developed for common structural polymers. Author

**N88-14203#** Netherlands Energy Research Foundation, Petten.
**STRUCTURAL INVESTIGATIONS OF SOME METALLIC GLASSES Ph.D. Thesis**
Jilt Sietsma Mar. 1987 185 p
(ECN-198; B8709130; ETN-88-91352) Avail: NTIS HC A09/MF A01

The structure of metallic glasses was studied by neutron diffraction and model calculations. Experimental results for amorphous Ni60 Nb40 are presented. Partial radial distribution functions (rRDF) of amorphous Fe40 Ni40 B20 suggest that the Fe and Ni atoms are randomly distributed over metal atom sites, and that the Ni-B nearest neighbor distance distribution is narrower than that of Fe-B pairs. Partial rRDF's for binary metallic glasses show that virtually all binary glasses basically have the same atomic scale structure, only slightly adapted to the specific concentration and atomic size ratio. The medium range order (r less than 0.35 mm) can be regarded as a disordered DO(e)-structure, the crystalline structure of, e.g., Fe3B. The short range order tends to be similar to that in the crystal of corresponding composition, but only as far as this is compatible with the prismatic (DO(e)) medium range order. ESA

**N88-14204#** Pennsylvania State Univ., University Park. Materials Research Lab.
**EXPLOITATION OF THE SOL-GEL ROUTE IN PROCESSING OF CERAMICS AND COMPOSITES Final Report, 15 May 1985 - 14 May 1987**
Rustum Roy 10 Jul. 1987 106 p
(Contract F49620-85-C-0069)
(AD-A185482; AFOSR-87-1193TR) Avail: NTIS HC A06/MF A01 CSCL 11D

Compositionally diphasic xerogels are very intimate mixtures composed of two solid phases each on the order of 10-20 nm. The two phases are different only in composition. Using the mullite (3Al2O3SiO2) system as the prototype model, it is shown that the compositionally diphasic materials sinter to a much lower temperature than the single phase gels. Such sintering of compositionally diphasic gels at much lower temperatures may be attributed, at least in part, to the heat of reaction of the two discrete phases at the sintering temperature. This notion was extended to other systems such as Al2TiO5, ZrSiO4, ThSiO4 and Mg2Al4SiO18. Results to date on the Al2TiO5, ZrSiO4 and ThSiO4 systems do not show significant improvements in densification behavior although the use of diphasic gels led to a reduction in the crystallization temperatures of ZrSiO4, ThSiO4, etc. The diphasic Mg2Al4Si5O18 system exhibits metastable melting which could be used for enhanced densification of this low-expansion ceramic. Using the diphasic approach, translucent ultra-low expansive titania-silica glasses were prepared with 0 to 10% TiOs. The coefficients of thermal expansion are intermediate between those of fused silica and a commercial titania-silica glass. The glass with 7.2% TiO2 exhibited a zero thermal expansion coefficient at 150-210 C. GRA

**N88-14205#** Southwest Research Inst., San Antonio, Tex.
**CHARACTERIZATION OF MECHANICAL DAMAGE MECHANISMS IN CERAMIC COMPOSITE MATERIALS Technical Report, 24 May 1986 - 23 May 1987**
James Lankford, Jr Aug. 1987 50 p
(Contract N00014-84-C-0213)
(AD-A185549; SWRI-06-8124) Avail: NTIS HC A03/MF A01 CSCL 11B

Earlier work on compressive strength of glass-ceramic matrix SiC fiber-reinforced composites is extended to define their behavior at high strain rates, and to assess the role of matrix phase versus fibers under such conditions. It is shown that the composite material can possess extremely high strain rate hardening exponents for strain rates in excess of about 400/s. These uniquely rapid increases in strength are found to depend on composite microstructure and its orientation relative to the load axis; specifically, such strengthening correlates with at least one major set of fiber bundles being parallel to the load axis. The latter fail by kink initiation and propagation, a highly strain rate dependent, temperature-independent process. For off-axis implusive-load situations, the pyroceram matrix itself plays a significant role in controlling failure. GRA

**N88-14206*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**THE EFFECT OF TEXTURE ON THE CRACK GROWTH RESISTANCE OF ALUMINA**
Jonathan A. Salem, John L. Shannon, Jr., and Richard C. Bradt (Washington Univ., Seattle.) 1987 25 p Presented at the 89th Annual Meeting of the American Ceramic Society, Pittsburgh, Pa., 27-30 Apr. 1987
(NASA-TM-100250; E-3873; NAS 1.15:100250; Rept-167-B-87)
Avail: NTIS HC A03/MF A01 CSCL 11B

The crack growth resistance of a textured, extruded alumina body was compared with that of an isotropic, isopressed body of similar grain size, density, and chemistry. R-curve levels reflected the preferred orientation; however, R-curve slopes (dK sub IR/d Delta a) were the same in all instances, implying a similar crack growth resistive mechanism. Three orthogonal orientations of crack growth in the two structures exhibited similar forms of K sub IR versus Delta-a curves, for which a schematic diagram for polycrystalline ceramics is proposed. Author

**N88-14207#** Army Materiel Command, Aberdeen Proving Ground, Md. Ballistic Research Lab.
**EVALUATION OF THE THERMAL EFFECTIVENESS OF URETHANE FOAM AND FIBERGLASS AS INSULATION SYSTEMS FOR TANK CARS Final Report, May - Sep. 1985**
W. P. Wright, W. A. Slack, and W. F. Jackson Jul. 1987 29 p Sponsored in part by Federal Railroad Administration, Washington, D.C.
(Contract DTFR53-84-X-00008)
(PB88-100797; DOT/FRA/ORD-87/11) Avail: NTIS HC A03/MF A01 CSCL 11B

A total of 39 thermal fire tests were conducted using the torch fire facility. These tests were performed in accordance with the Code of Fed. Reg., Part 179.105-4. The insulations tested were urethane foam and fiberglass. Urethane foam is installed on a number of railroad tank cars which are used to transport chlorine. Fiberglass constitutes the insulation system on a number of tank cars which are used to transport other materials. In the test series, it was found that urethane foam can hold the tank car shell below

493 F in the environments which may exist in railroad accidents. This test criteria is a more stringent requirement than previously imposed for the insulation system of the chlorine tank car. The fiberglass performed much better than anticipated when a means was provided to hold it in place in the test fixture during the tests. It war recommended that the test specimen holder be redesigned if the modification is satisfactory and to verify that fiberglass has the ability to hold the back plate temperature below 800 F. Author

**N88-14133#** Joint Publications Research Service, Arlington, Va.
**MATERIAL DESIGN OF HIGH-PURPOSE GLASS DISCUSSED**
Itaru Yasui *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 26-39 Transl. into ENGLISH from Kino Zairyo (Tokyo, Japan), Mar. 1987 p 44-53 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

**N88-14140#** Joint Publications Research Service, Arlington, Va.
**HIGH POLYMER SENSOR MATERIALS DISCUSSED**
Sachio Hirose *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 72-79 Transl. into ENGLISH from Sensor Gijutsu (Tokyo, Japan), Dec. 1986 p 50-53 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

**N88-14141#** Joint Publications Research Service, Arlington, Va.
**POLYMER MATERIALS FOR PRESSURE SENSORS**
Hiroji Ohigashi and Kiyoto Koyama *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 80-86 Transl. into ENGLISH from Sensor Gijitsu (Tokyo, Japan), Dec. 1986 p 54-57 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

**N88-14142#** Joint Publications Research Service, Arlington, Va.
**POLYMER MATERIAL FOR HEAT SENSORS**
Ikuo Sato *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 86-93 Transl. into ENGLISH from Sensor Gijitsu (Tokyo, Japan), Dec. 1986 p 58-61 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

**N88-14216#** Joint Publications Research Service, Arlington, Va.
**MATERIAL DESIGN OF HIGH PERFORMANCE GLASSES DISCUSSED**
*In its* JPRS Report: Science and Technology. Japan 23 Sep. 1987 p 17-29 Transl. into ENGLISH from Kino Zairyo (Tokyo, Japan), Feb. 1987 p 42-52 (For primary document see N88-14213 06-31)
Avail: NTIS HC A05/MF A01

# 28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

**N88-14208#** Foersvarets Forskingsansalt, Stockholm (Sweden).
**COMPATIBILITY OF EXPLOSIVES: A DATA BASE SYSTEM**
A. G. Nord and A. Alm Jul. 1987 29 p
(PB87-234464; FOA-C-20661-2.3) Copyright Avail: NTIS HC A03/MF A01 CSCL 19A

The Swedish standard method for testing the compatibility of explosives is the FOA Weight Loss Test. A data base containing 1872 compatibility test records determined with this technique was implemented on an IBM compatible PC computer. The tests were performed by FFV Ordnance, and the data processed by FOA. The computer programs are described along with the basic structure of the data file. Author

**N88-14209#** Department of Energy, Washington, D. C. Office of Basic Energy Sciences.
**RESEARCH NEEDS FOR HYDROCARBON FUELS**
1987 116 p Presented at the Workshop on Not Yet Visible or Recoverable Hydrocarbons, Woodland, Tex., 11 May 1987
(Contract DE-FG05-84ER-13228)
(DE87-014555; CONF-8705179) Avail: NTIS HC A06/MF A01

A DOE sponsored workshop was held early in May, 1987, at the Houston Area Research Center, Texas, to outline research requirements for enhancing future domestic production of hydrocarbons. Not only was the result a large number of suggested research programs and themes but, in addition, several central recommendations emerged. A matrix format for the meeting was chosen in which the workshop members were divided among eight thematic panels: (1) new ways to study the earth; (2) deep gas; (3) the subtle, complex and hard-to-see traps; (4) mapping source beds and seals; (5) new settings for exploration; (6) reservoir characterization; (7) reservoir mechanisms and transport properties; (8) reservoir management; and among the cross-cutting disciplines of geology, geochemistry, geophysics, and petroleum engineering. Most of the allotted time was spent in the thematic panels. Reporting of the tentative findings of the thematic panels was accomplished during a plenary session and those findings were reviewed when the members reconvened and respond to the contribution of the cross-cutting disciplinary groups. These panel reports are presented in Appendix A of this report. DOE

**N88-14210#** Sandia National Labs., Albuquerque, N. Mex.
**LANGLIE TEST METHOD PROGRAM FOR USE WITH THE HP-41CV/X CALCULATOR**
M. R. Kopczewski Oct. 1987 27 p
(Contract DE-AC04-76DP-00789)
(DE88-001935; SAND-87-0784) Avail: NTIS HC A03/MF A01

Explosive component designers need to test the sensitivity of some unit response as a function level of stress, for example, the sensitivity of a detonator or ignitor bridgewire to input current. There exists a threshold level, above which the detonator will function and below which it will not. Statistical testing of explosive components often requires destructive testing of expensive hardware. If the unit functions, it is destroyed; and if it doesn't fire, the results from any further testing cannot be relied on because the initial test affects the detonator. In order to obtain meaningful results and not expend a large number of units, the Langlie One-Shot Method of testing is employed. Typical component attributes that require Langlie testing include all-fire and no-fire tests to determine threshold levels of performance. Generally, any sensitivity testing lends itself to the Langlie method. This method has also been shown to be insensitive to design. Typically, support test groups and venders implement the test method with their own computers. The method is subject to some interpretation which may lead to inconsistency in results from facility to facility. DOE

**N88-14211#** Ashland Petroleum Co., Ky.
**AVIATION TURBINE FUELS FROM TAR SANDS BITUMEN AND HEAVY OILS. PART 2: LABORATORY SAMPLE PRODUCTION**
**Technical Report, 1 Apr. 1984 - 31 May 1985**
H. F. Moore, C. A. Johnson, D. A. Fabry, M. H. Chaffin, and W. A. Sutton Jul. 1987 136 p
(Contract F33615-83-C-2301)
(AD-A185744; AFWAL-TR-84-2070-Pt-2) Avail: NTIS HC A07/MF A01 CSCL 21D

Phase 2 work performed on small bench scale laboratory units was to validate the process variables identified in Phase 1. As a part of this effort, samples (quanity 500 ML to 1000 ML) of JP4, JP8, were produced and submitted to AFWAL for their evaluation. Detailed characterizations of the tar sand feedstocks and product samples were performed. From the data generated in Phase 2, specific goals and tests were outlined for Phase 3 of the program. GRA

# 29 MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications.
For biological materials see *55 Space Biology*.

**N88-14212*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**GROWTH OF SOLID SOLUTION SINGLE CRYSTALS**
S. L. Lehoczky and F. R. Szofran Dec. 1987 18 p
(NASA-TP-2787; NAS 1.60:2787) Avail: NTIS HC A03/MF A01 CSCL 20B

Based on the thermophysical properties of Hg sub 1-x Cd sub x Te alloys, the reasons are discussed for the failure of conventional Bridgman-Stockbarger growth methods to produce high quality homogeneous crystals in the presence of Earth's gravity. The deleterious effects are considered which arise from the dependence of the thermophysical properties on temperature and composition and from the large amount of heat carried by the fused silica ampules. An improved growth method, developed to optimize heat flow conditions, is described and experimental results are presented. The problems associated with growth in a gravitational environment are discussed. The anticipated advantages of growth in microgravity are given and the implications of the requirements for spaceflight experiments are summarized. Author

# 31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

**N88-14213#** Joint Publications Research Service, Arlington, Va.
**JPRS REPORT: SCIENCE AND TECHNOLOGY. JAPAN**
23 Sep. 1987 91 p Transl. into ENGLISH from various Japanese articles
(JPRS-JST-87-027) Avail: NTIS HC A05/MF A01

Topics in science and technology addressed include: advanced materials; civil aviation; automative industry; aerospace engineering; defense industries; energy technology; lasers, optics, sensors; and telecommunication. For individual titles, see N88-14214 through N88-14222.

**N88-14214#** Joint Publications Research Service, Arlington, Va.
**HITACHI DEVELOPS CERAMIC SUPERCONDUCTING DEVICE Abstract Only** **c76**
*In its* JPRS Report: Science and Technology. Japan 23 Sep. 1987 p 1 Transl. into ENGLISH from Kyodo (Tokyo, Japan), 11 Aug. 1987 (For primary document see N88-14213 06-31)
Avail: NTIS HC A05/MF A01

A ceramic superconducting quantum interference device (squid) made into the form of a fine film by applying its semiconductor fine process technology was tested. The squid, which reached its superconducting temperature through cooling with a cheap liquid nitrogen at minus 196 C, can detect faint magnetic fields with a strength only a millionth that of the Earth's magnetic field. This means that the squid can be incorporated into medical diagnostic equipment intended for diagnosing brain and heart disorders by catching changes in the extremely weak magnetic fields these organs generate. Hitachi's squid is made using a high frequency sputtering process to form a thin film of yttrium-barium-copper oxide onto a substrate of magnesium oxide, which is then heat treated in an oxygen environment. The resulting superconducting film is one to two microns thick and superconducts at minus 187 C, at which temperature it has a maximum current density in excess of 6,000 amperes per square centimeter. Optical exposure and chemical etching process are then used to make a hole in the middle of the film, after which two Josephson junctions are connected to both of the holes to form a squid. Author

**N88-14215#** Joint Publications Research Service, Arlington, Va.
**RECENT TRENDS IN SUPERCONDUCTOR DEVELOPMENT DISCUSSED** **c76**
Hideo Ihara *In its* JPRS Report: Science and Technology. Japan 23 Sep. 1987 p 2-16 Transl. into ENGLISH of Shin Kinzoku Kogyo (Tokyo, Japan), 1986 p 1-8 (For primary document see N88-14213 06-31)
Avail: NTIS HC A05/MF A01

The possibilities for new superconductors are discussed. Topics for superconductor development fall into the following six categories: development of high critical temperature materials; development of higher critical magnetic field and high critical electric current density materials; development of materials for high performance Josephson elements and Fluxon elements; development of superconductors with new functions; and development of superconductors with new materials. Development objectives for these categories are summarized along with related materials. B.G.

**N88-14216#** Joint Publications Research Service, Arlington, Va.
**MATERIAL DESIGN OF HIGH PERFORMANCE GLASSES DISCUSSED** **c27**
*In its* JPRS Report: Science and Technology. Japan 23 Sep. 1987 p 17-29 Transl. into ENGLISH from Kino Zairyo (Tokyo, Japan), Feb. 1987 p 42-52 (For primary document see N88-14213 06-31)
Avail: NTIS HC A05/MF A01

High-grade materials are necessary for building a highly advanced system. This is the reason new and up-to-date materials attract attention. In the field of glass, a material called the new glass is attracting attention as an up-to-date glass. In view of this situation, a survey of the functions the new glass has as a glass is made, and in what manner such a functional glass can be designed is related. Author

**N88-14217#** Joint Publications Research Service, Arlington, Va.
**SUPERCONDUCTING MATERIAL DEVELOPMENT Abstract Only** **c76**
*In its* JPRS Report: Science and Technology. Japan 23 Sep. 1987 p 30 Transl. into ENGLISH from Japanese Journal of Applied Sciences (Tokyo, Japan), 4 Aug. 1987 (For primary document see N88-14213 06-31)
Avail: NTIS HC A05/MF A01

A superconducting compound was developed that showed a transition to a zero-resistance state at 65 C, or 338 K. The superconducting material, which is an oxide based on strontium, barium, yttrium, and copper, continued in the zero-resistance state similar to superconductivity for 10 days at room temperature in the air. It was also noted that measurements of the material allowed it to observe a nonlinear characteristic curve between current and voltage at 65 C, which is another indication of superconductivity. The research results of the laboratory experiment with the superconducting material will be published in the August edition of the Japanese Journal of Applied Physics. Author

**N88-14218#** Joint Publications Research Service, Arlington, Va.
**COUNTRY PLANS THREE-AXIS WEATHER SATELLITE Abstract Only** **c18**
*In its* JPRS Report: Science and Technology. Japan 23 Sep. 1987 p 31 Transl. into ENGLISH from Aerospace Japan-Weekly (Tokyo, Japan), 3 Aug. 1987 p 5, 6 (For primary document see N88-14213 06-31)
Avail: NTIS HC A05/MF A01

The Meteorological Agency and the National Space Development Agency of Japan (NASDA) plan to replace the spin-stabilization system now used in the Himawari series weather satellites with the three-axis stabilization system beginning with the fifth weather satellite which is scheduled for launch in 1993. The planned satellite will be supplied by either Ford Aerospace of the U.S. or Aerospatiale of France. It will be equipped with two infrared cameras to improve observation capabilities. The currently operational Himawari-3 weather satellite is basically the same as the U.S. Geostationary Operational Environmental Satellite (GOES) developed by Hughes Aircraft. It is a spin-stabilization. Japan plans to launch another spin-stabilization weather satellite or the Himawari-4 in August 1989. The planned three-axis stabilization satellite will be launched in 1993 as the Himawari-5. Launching

cost is estimated at 30 billion yen compared with 22 billion yen now required for the conventional spin-stabilization satellite.
Author

**N88-14219#** Joint Publications Research Service, Arlington, Va.
**DEVELOPMENT, FEATURES OF ROLLER ROCKER ARM REPORTED** **c37**
*In its* JPRS Report: Science and Technology. Japan 23 Sep. 1987 p 34-36 Transl. into ENGLISH from Nainei Kikan (Tokyo, Japan), Jun. 1987 p 47-52 (For primary document see N88-14213 06-31)
Avail: NTIS HC A05/MF A01

The special features and structure of the needle roller arm system rocker and the effect of its use, from the point of engine friction, are described. B.G.

**N88-14220#** Joint Publications Research Service, Arlington, Va.
**DEVELOPMENTS IN OPTICAL SENSOR TECHNOLOGIES DESCRIBED** **c74**
Tatehiko Hidaka *In its* JPRS Report: Science and Technology, Japan 23 Sep. 1987 p 50-62 Transl. into ENGLISH from Optronics (Tokyo, Japan), Dec. 1986 p 74-80 (For primary document see N88-14213 06-31)
Avail: NTIS HC A05/MF A01

As lasers diffused, microgas analysis technology utilizing their excellence in spectral purity and coherence was developed in recent years. The current project also tackled the development of high sensitivity gas analysis technology utilizing so-called hollow fibers in the infrared and the ultraviolet soft X-ray areas. Initially, hollow fibers for the medium infrared area (910 micron band) and then experiments of hollow fibers for soft X-rays (25 to 27 A) were made. Since sensor technologies need precision measuring technology for micropower, the current project has studied and established precision light attenuation measuring technology using an acousto-optic element. These technologies are likely to be integrated to contribute to the progress in new optical sensor technologies in the future. Author

**N88-14221#** Joint Publications Research Service, Arlington, Va.
**LASER DEVELOPMENT, EVOLUTION OF APPLIED TECHNOLOGIES DESCRIBED** **c36**
Takuzo Sato *In its* JPRS Report: Science and Technology. Japan 23 Sep. 1987 p 63-73 Transl. into ENGLISH from Optronics (Tokyo, Japan), Jan. 1987 p 86-91 (For primary document see N88-14213 06-31)
Avail: NTIS HC A05/MF A01

The development of lasers and the trend of applied technologies were outlined. Progress in laser technologies has never stopped during the quarter of a century since its invention and it is not known where it will stop. Laser technologies were developed in succession and are in turn inducing new technologies. Demand for the room temperature CW oscillation semiconductor laser has, for example, expanded from optical fiber communications to the applied sector of welfare and industrial equipment including a laser printer. Future progress is to be noted and expected in lasers and applied technologies such as laser machining technology mixing laser technology with robotics, ultramachining technology, and laser isotope separation using the excimer laser. Author

**N88-14222#** Joint Publications Research Service, Arlington, Va.
**STATUS, OUTLOOK OF OPTICAL TECHNOLOGY IN INFORMATION EQUIPMENT FIELD** **c74**
*In its* JPRS Report: Science and Technology. Japan 23 Sep. 1987 p 74-87 Transl. into ENGLISH from Optronics (Tokyo, Japan), Mar. 1987 p 65-73 (For primary document see N88-14213 06-31)
Avail: NTIS HC A05/MF A01

The highly touted electronics industry, expected to be the trigger industry of the 1980s, suddenly lost steam in the latter half of the 1980s. In this situation, only optoelectronics is experiencing a boom in business. The effects that massive data processing technology, information stocking, information transmission, light emitting diodes (LEDs), laser applications, storage devices, and optical cards have on the expansion of optoelectronics are discussed. B.G.

**N88-14223*** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**OXYGEN CHEMISORPTION CRYOGENIC REFRIGERATOR Patent**
Jack A. Jones, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 6 Oct. 1987 6 p Filed 24 Apr. 1986 Supersedes N86-27467 (24 - 18, p 2879)
(NASA-Case-NPO-16734-1-CU; US-Patent-4,697,425; US-Patent-Appl-SN-855982; US-Patent-Class-62-48; US-Patent-Class-62-467; US-Patent-Class-62-514R) Avail: US Patent and Trademark Office CSCL 13B

The present invention relates to a chemisorption compressor cryogenic refrigerator which employs oxygen to provide cooling at 60 to 100 K. The invention includes dual vessels containing an oxygen absorbent material, alternately heated and cooled to provide a continuous flow of high pressure oxygen, multiple heat exchangers for precooling the oxygen, a Joule-Thomson expansion valve system for expanding the oxygen to partially liquefy it and a liquid oxygen pressure vessel. The primary novelty is that, while it was believed that once oxygen combined with an element or compound the reaction could not reverse to release gaseous oxygen, in this case oxygen will indeed react in a reversible fashion with certain materials and will do so at temperatures and pressures which make it practical for incorporation into a cryogenic refrigeration system.
Official Gazette of the U.S. Patent and Trademark Office

**N88-14224#** Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Vienna. Inst. fuer Chemie.
**RADIATION CURING: COMPARISON OF HEAT, UV, AND RADIATION CURING**
Josef Wendrinsky Apr. 1987 52 p Presented at the IAEA Advisory Group Meeting, Dubrovnik, Yugoslavia, 6-8 Oct. 1986 (OEFZS-4393; CH-371/87; ETN-88-90726) Copyright Avail: NTIS HC A04/MF A01

Applications of radiation curing and advantages and disadvantages of this technology are reviewed. Case studies emphasizing the features of these processes and example calculations are outlined. The data used for the calculations provide an easy calculation of individual manufacturing costs if special production parameters, investment, or energy costs are involved.
ESA

**N88-14225#** National Bureau of Standards, Gaithersburg, Md.
**UNIFORM LAWS AND REGULATIONS AS ADOPTED BY THE NATIONAL CONFERENCE ON WEIGHTS AND MEASURES (72ND), 1987**
Carroll S. Brickenkamp Sep. 1987 193 p
(PB88-123724; NBS/HB-130-1988) Avail: NTIS HC A09/MF A01; also available SOD HC $10.00 as 003-003-02814-2 CSCL 13B

The handbook, revised annually, compiles the uniform laws and regulations developed by the Committee on Laws and Regulations of the National Conference on Weights and Measures (NCWM). The compilation itself was approved by the NCWM in 1979, and this edition includes amendments adopted by the Conference at its annual meeting in 1987. The edition also contains a new motor fuel inspection law and regulation. The NCWM recommends adoption and promulgation by the states of these uniform laws and regulations as updated in the handbook. GRA

# 32 COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Space Communications, Spacecraft Communications, Command and Tracking.* For search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation.*

**N88-14226*#** Colorado Univ., Boulder. Dept. of Electrical Engineering.

**PROPAGATION EFFECTS ON SATELLITE SYSTEMS AT FREQUENCIES BELOW 10 GHz: A HANDBOOK FOR SATELLITE SYSTEMS DESIGN**

Warren L. Flock Dec. 1987 501 p
(Contracts NAS7-100; JPL-956249)
(NASA-RP-1108/2; NAS 1.61:1108/2) Avail: NTIS HC A22/MF A01 CSCL 22D

Frequencies below 10 GHz continue to be used for a large portion of satellite service, and new applications, including mobile satellite service and the global positioning system, use frequencies below 10 GHz. As frequency decreases below 10 GHz, attenuation due to precipitation and gases decreases and ionospheric effects increase. Thus the ionosphere, which can be largely neglected above 10 GHz, receives major attention. Although attenuation and depolarization due to rain are less severe below 10 GHz than above, they are nevertheless still important and constitute another major topic. The handbook emphasizes the propagation effects on satellite communications but material that is pertinent to radio navigation and positioning systems and deep-space telecommunications is included as well. Chapter 1 through 7 describe the various propagation impairments, and Chapter 9 is devoted to the estimation or calculation of the magnitudes of these effects for use in system design. Chapter 10 covers link power budget equations and the role of propagation effects in these equations. Chapter 8 deals with the complex subject of interference between space and terrestrial systems. Author

**N88-14227#** Communications Research Centre, Ottawa (Ontario).

**THEORY OF DISPLACED PHASE CENTER ANTENNA FOR SPACE BASED RADAR APPLICATIONS**

W. Tam and D. Faubert Dec. 1986 58 p Sponsored by Department of National Defence, Ottawa, Ontario
(PB87-229837; CRC-1409) Avail: NTIS HC A04/MF A01 CSCL 20N

A theory of the displaced phase center antenna system for space based on radar applications is presented. The matching condition required to compensate for the motion of the satellite platform so that clutter cancellation can be achieved is first derived. Analytical expressions for the signal and clutter covariance matrices are given. With the aid of a simplified model, numerical values of an improvement factor are obtained. These results illustrate the dependence of the level of clutter rejection on radar parameters such as: grazing angle, pulse train duration, pulse repetition rate, and antenna aperture size. GRA

**N88-14228#** Federal Communications Commission, Washington, D. C. Engineering Evaluation Branch.

**RECEIVER SUSCEPTIBILITY MEASUREMENTS RELATING TO INTERFERENCE BETWEEN UHF (ULTRA HIGH FREQUENCY) TELEVISION AND LAND MOBILE RADIO SERVICES**

D. J. Stanks Feb. 1987 21 p
(PB87-228029; EEB-84-4) Avail: NTIS HC A03/MF A01 CSCL 17B

Certain susceptibilities of a sample of 27 modern television receiver to interference caused by land mobile transmission are described. In particular, situations in which the land mobile stations were operating on frequencies adjacent to, coincident with, and on an image of a desired television channel were studied. Land mobile receivers are also susceptible to interference caused by television broadcast transmitters in certain situations. The susceptibilities of a sample of three land mobile receivers to television broadcast operating in close frequency proximity to a desired land mobile channel are described. GRA

**N88-14229#** National Telecommunications and Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.

**PROGRAM DESCRIPTION OF FIBRAM: A RADIATION ATTENUATION MODEL FOR OPTICAL FIBERS**

W. J. Ingram Jun. 1987 117 p
(PB87-230686; NTIA-87-216; NCS-TIB-87-22; COM/SW/DK-87/005A) Avail: NTIS HC A06/MF A01 CSCL 17B

A fiber optics system model and its computer implementation are described. This implementation can calculate the bit error ratio (BER) versus time for optical fibers that were exposed to gamma radiation. The program is designed so that the user may arbitrarily change any or all of the system input variables and produce separate output calculations. The primary output of the program is a table of BER as a function of time. This table may be stored on magnetic media and later incorporated into computer graphics. GRA

**N88-14230#** Argonne National Lab., Ill.

**PROCEEDINGS OF THE 2ND REGIONAL ELECTROMAGNETIC WORKSHOP AT ARGONNE NATIONAL LABORATORY**

L. R. Turner, ed. Dec. 1986 99 p Workshop held in Argonne Ill., 23 Jun. 1986
(Contract W-31109-eng-38)
(DE87-004633; ANL/FPP/TM-210; CONF-8606260-Summ) Avail: NTIS HC A05/MF A01

Separate abstracts were entered into the data base for each of the 7 included papers. Topics addressed include: 3-D transient eddy current; electromagnetism; and eddy current calculations using the magnetic vector potential. DOE

**N88-14231#** Northwestern Univ., Evanston, Ill. Dept. of Electrical Engineering and Computer Science.

**ADVANCED NUMERICAL MODELING OF MICROWAVE PENETRATION AND COUPLING FOR COMPLEX STRUCTURES Final Report, Jan. 1985 - Jun. 1987**

A. Taflove and K. R. Umashankar Sep. 1987 211 p Prepared in cooperation with Illinois Univ., Chicago and Lawrence Livermore National Lab., Calif.
(Contract W-7405-eng-48)
(DE88-001873; UCRL-15960) Avail: NTIS HC A10/MF A01

This research program has established a systematic numerical approach to model electromagnetic wave coupling phenomena related to slot apertures and wire bundles associated with complex, cavity-type structures. VAX-type software providing computational examples of the numerical methods is available. Efficient Cray-type software (providing enhanced user friendliness) is under development. DOE

**N88-14232*#** Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

**ELECTROMAGNETIC WAVE PROBING OF EARTH'S ENVIRONMENT Final Report, 1 Feb. - 31 Dec. 1987**

Jin Au Kong 22 Jan. 1988 6 p
(Grant NAG5-889)
(NASA-CR-182358; NAS 1.26:182358) Avail: NTIS HC A02/MF A01 CSCL 20N

Polarimetric radar backscattering from anisotropic Earth terrain such as snow-covered ice fields and vegetation fields with row structures provides a challenging modeling problem from the electromagnetic wave point of view. Earth terrain covers are modeled as random media characterized by different dielectric constants and correlation functions. A three-layer model will be used to simulate a vegetation field or a snow-covered ice field with the top layer being snow or leaves, the middle layer being ice of trunks, and the bottom layer being sea water or ground. The volume scattering effects of snow-covered sea ice are studied with a three-layer random medium model for microwave remote sensing. The strong fluctuation theory and the bilocal approximation

are applied to calculate the effective permittivities for snow and sea ice. The wave scattering theory in conjunction with the distorted Born approximation is then used to compute bistatic coefficients and backscattering cross sections. Theoretical results are illustrated by matching experimental data for dry snow-covered thick first-year sea ice at Point Barrow. The results derived can also be applied to the passive remote sensing by calculating the emissivity from the bistatic scattering coefficients. Author

**N88-14233#** Oulu Univ. (Finland). Dept. of Physics.
**REPORT OF THE 3RD FINNISH EISCAT WORKSHOP**
Mar. 1987 99 p Partly in FINNISH and ENGLISH Workshop held in Oulu, Finland, 15-17 Dec. 1986
(Rept-111; ISBN-951-42-2308X; ISSN-0356-1852; ETN-88-90297)
Avail: NTIS HC A05/MF A01

Finnish EISCAT or VIKING/EISCAT programs, the measurement of D region ionization, observation of a pulsating sporadic E Layer, computation procedures, EISCAT data analysis, and black auroras observations were discussed. For individual titles, see N88-14234 through N88-14244.

**N88-14234#** Oulu Univ. (Finland). Dept. of Physics.
**EISCAT RESEARCH IN FINLAND IN 1986 [EISCAT-TUTKIMUS V. 1986 - SUOMALAINEN KATSAUS]**
Jorma Kangas *In its* Report of the 3rd Finnish EISCAT Workshop Mar. 1987 p 1-5 In FINNISH; ENGLISH summary (For primary document see N88-14233 06-32)
Avail: NTIS HC A05/MF A01

The scientific programs included the participation in EISCAT-Viking and Viking campaigns, the development of a method to measure the ion neutral collision frequency using incoherent scatter radar, a Barker coded high resolution EISCAT experiment, observations on the statistical theory of incoherent radar measurements, reporting polar cap events observations, and measurements of D region ionization cause by solar radiation. ESA

**N88-14235#** Oulu Univ. (Finland).
**FINNISH CONTRIBUTIONS TO EISCAT SCIENCE IN 1986**
*In its* Report of the 3rd Finnish EISCAT Workshop Mar. 1987 p 7-12 (For primary document see N88-14233 06-32)
Avail: NTIS HC A05/MF A01

A method to measure the ion-neutral collision frequency; EISCAT measurements with 300 m height resolution; the statistical theory of incoherent scatter radar measurements; observations of the polar cap absorption event of February 1984; and the EISCAT measurement of D-region ionization caused by direct solar radiation are discussed. ESA

**N88-14236#** EISCAT Scientific Association, Kiruna (Sweden).
**CP-1-H ANALYSIS TESTS**
Tauno Turunen *In* Oulo Univ., Report of the 3rd Finnish EISCAT Workshop Mar. 1987 p 15-25 (For primary document see N88-14233 06-32)
Avail: NTIS HC A05/MF A01

A CP-1-H test was done on 10 November 1986. The performance of the experiment is studied using comparisons of the monostatic part and the remote station part, and pulse coded part and the long pulse part. One of the goals of the experiment was to evaluate the difficulties users have when trying to analyze this kind of tape. No special difficulties are found. The data presented include F-plots, electron density profiles, ion and electron temperature, electron density, and ion velocity. Comparisons of pulse coded part and the long pulse part of the experiment are given. ESA

**N88-14237#** Oulu Univ. (Finland).
**THE NEW CP3**
C. LaHoz *In its* Report of the 3rd Finnish EISCAT Workshop Mar. 1987 p 27-39 (For primary document see N88-14233 06-32)
Avail: NTIS HC A05/MF A01

The E version of CP3 and an assessment of the performance of this program are presented. The geometrical configuration of the experiment, the location, and function of the 17 positions are described. Data from three sites is used to compare the consistency of the fitted scalar parameters between the sites. There are consistent differences between any two sites when comparing a given scalar parameter. The conclusion is that the use of CP-3-E data for the purpose of anisotropy studies should be made with care if at all. Nevertheless, estimates of velocities are the most important parameter measured by CP-3, and tristatic measurements made by CP-3-E are quite satisfactory. ESA

**N88-14238#** Finnish Meteorological Inst., Helsinki. Div. of Geomagnetism.
**THE SOLUTION OF LARGE LINEAR INVERSE PROBLEMS** **c64**
Markku S. Lehtinen *In* Oulu Univ., Report of the 3rd Finnish EISCAT Workshop Mar. 1987 p 41-49 (For primary document see N88-14233 06-32)
Avail: NTIS HC A05/MF A01

Calculations of the spline coefficients from the measured lagged products in incoherent scatter measurements are presented as a linear inverse problem with 4000 measurements and 1000 unknowns. A possible practical solution to these problems is based on a variation of QR-decomposition. The calculation times on various computers are discussed. It is shown that the inversion estimate is optimal in the sense that it has smaller variance than any other estimator. ESA

**N88-14239#** Finnish Meteorological Inst., Helsinki. Div. of Geomagnetism.
**INCOHERENT RADAR SPECTRA [EPAEKOHERENTIN SIRONNAN SPEKTRI]**
Matti K. Vallinkoski *In* Oulu Univ., Report of the 3rd Finnish EISCAT Workshop Mar. 1987 p 51-59 In FINNISH; ENGLISH summary (For primary document see N88-14233 06-32)
Avail: NTIS HC A05/MF A01

General expressions for the incoherent scatter spectra are presented. These are relevant for the UHF radar in the monostatic backscatter case (thus excluding only the effect of the magnetic field), based on the Nyquist approach. ESA

**N88-14240#** Oulu Univ. (Finland). Dept. of Physics.
**CORRECTION METHOD FOR BARKER-CODED MODULATION [SIVUNAUHOJEN VAIKUTUS BARKER-KOODATUISSA KOKEISSA]**
Asko Huuskonen, Paeivioe Pollari, and Tuomo Nygren *In its* Report of the 3rd Finnish EISCAT Workshop Mar. 1987 p 61-67 In FINNISH; ENGLISH summary (For primary document see N88-14233 06-32)
Avail: NTIS HC A05/MF A01

A correction method for Barker-coded multipulse modulation sideband effects is presented. This code is used in incoherent scatter experiments. The measured autocorrelation functions are contaminated by signals from spatial ambiguities due to sidebands of the code. The correction is found to reduce the residual of the fit by an order of magnitude. However, changes in the physical parameters are rather small. For instance the temperatures below 110 km altitude are reduced only by a few Kelvin. ESA

**N88-14241#** Oulu Univ. (Finland). Dept. of Physics.
**DATA ANALYSIS AT THE OULU (FINLAND) EISCAT LABORATORY [DATA-ANALYSIOLUN EISCAT-LABORATORIOSSA]**
Paeivioe Pollari and Anita Aikio *In its* Report of the 3rd Finnish EISCAT Workshop Mar. 1987 p 69-71 In FINNISH (For primary document see N88-14233 06-32)
Avail: NTIS HC A05/MF A01

Radar processing hardware and procedures are described. The computer facilities include the IBM 3083 computer, the IBM 3179G unit with 712x384 resolution in 7 colors, and IBM AT color microcomputer provided with the EGA high resolution card. The computation procedures and the computer network communication

paths are explained. The signal processing steps are detailed. ESA

**N88-14242#** Geophysical Observatory, Sodankyla (Finland).
**DESCRIPTION OF DATA HANDLING SYSTEM INSTALLED DECEMBER 11, 1986** **c82**
Anna-Liisa Turunen *In* Oulu Univ., Report of the 3rd Finnish EISCAT Workshop Mar. 1987 p 73-75 (For primary document see N88-14233 06-32)
Avail: NTIS HC A05/MF A01

The usage of the EROS EISCAT data recording on disk and the retrieval of the data on physical tapes is described. The disk set consists of 4 continuous files on user DATA-EISCAT. Standard sizes are given. Creating, initializing and testing of disk sets is also explained. ESA

**N88-14243#** Finnish Meteorological Inst., Helsinki. Div. of Geomagnetism.
**VIKING QUICK LOOK PLOTS: A SHORT DESCRIPTION [VIKING-SATELLIITIN TULOKSISTA JA NIIDEN HYVAEKSIKAEYTOESTAE EISCAT-TUTKIMUKSESSA]** **c82**
Risto Pellinen *In* Oulu Univ., Report of the 3rd Finnish EISCAT Workshop Mar. 1987 p 79-90 Partly in FINNISH and ENGLISH (For primary document see N88-14233 06-32)
Avail: NTIS HC A05/MF A01

The Viking quick look plots (QLP) are described. The QLP consist of one set of five pages for each data taking period. One data taking period is up to 150 min duration. There is normally one data taking period per orbit. The Viking orbit period is 262 min. Each page has the same time scale, approximately 16 min/in. Auroral and magnetic data from QLP are presented. ESA

**N88-14244#** Oulu Univ. (Finland). Dept. of Physics.
**EISCAT RESEARCH PROGRAMS FOR 1987 [EISCAT-TUTKIMUKSEN TAVOITTEET V. 1987]** **c46**
Jorma Kangas *In its* Report of the 3rd Finnish EISCAT Workshop Mar. 1987 p 91-92 In FINNISH (For primary document see N88-14233 06-32)
Avail: NTIS HC A05/MF A01

The main orientations of EISCAT research programs in Finland are summarized. The subjects include Viking satellite combined auroral and ionosphere observation, and middle atmosphere studies such as the high resolution auroral experiment, and the alternating code test. ESA

**N88-14245#** Research Inst. of National Defence, Linkoeping (Sweden). Dept. 3.
**ON THE INFLUENCE OF FALSE PLOTS ON TRACKING RELAIBILITY: SIMULATIONS AND PRELIMINARY ANALYSES**
Boerje Salomonsson Apr. 1987 44 p In SWEDISH; ENGLISH summary
(FOA-C-30443-3.2; ISSN-0347-3708; ETN-88-90743) Avail: NTIS HC A03/MF A01; Research Institute of National Defence, Stockholm, Sweden KR 50

The influence of the density of false plots, the probability of detection and a priori statistics of the target for a target tracking system was studied using Monte-Carlo methods. Statistical rosults were obtained by letting the system track a number of nonmaneuvering targets through a wide area with false plots. It is shown that using track splitting and usual filtering coefficients, the tracking performance starts to deteriorate at 1 false plot per 100 sq km. ESA

**N88-14246#** Research Inst. of National Defence, Linkoeping (Sweden). Applied Electronics Dept.
**A PAPER ABOUT ELECTROMAGNETIC PULSE AND PRINCIPLES OF EMP PROTECTION**
Kerstin Kocken Apr. 1987 27 p In SWEDISH; ENGLISH summary
(FOA-C-30455-4.2; ISSN-0347-3708; ETN-88-90746) Avail: NTIS HC A03/MF A01; Research Institute of National Defence, Stockholm, Sweden KR 50

General information on electromagnetic pulses (EMP) and their effects, as well as EMP simulation, and methods of EMP protection is given. It is noted that older type alarm devices can be less sensitive than modern; problems in a power plant and with telephones are reported. Elements of a system which may deteriorate must be protected by shielding, isolation or transient protection methods. The concept Controlled Electromagnetic Topology is presented along with a topological definition of modes to ground the system to be protected. ESA

**N88-14247#** Research Inst. of National Defence, Linkoeping (Sweden).
**RADIO FREQUENCY ELECTROMAGNETIC INTERFERENCE FIELDS. A STUDY IN SWEDISH INDUSTRY**
Mats Gunnerhed, Stig Boberg, and Lars Knutsson Jun. 1987 36 p In SWEDISH; ENGLISH summary Sponsored by the Swedish Work Environment Fund
(FOA-E-30007-3.3; ISSN-0281-9937; ETN-88-90748) Avail: NTIS HC A03/MF A01; Research Institute of National Defence, Stockholm, Sweden KR 50

Disturbances due to electromagnetic interference in workshops were studied. Measurements of the radiated electromagnetic environment were carried out in the engineering industry on normal working days, and if possible at a distance of 3 to 5 m from a supposed disturbance source. The measured frequency range was 25 to 500 MHz, and the band width 100 KHz and 1MHz. For every test point measurements lasted for 10 min. Electric and magnetic fields were controlled. The effect of the radiated electric disturbance depends not only on its amplitude and its frequency. Data of all measurements are reported. ESA

**N88-14248#** National Aerospace Lab., Amsterdam (Netherlands). Space Div.
**STUDY OF SYNTHETIC APERTURE RADAR DATA COMPRESSION AND ENCODING. PART 3: PERFORMANCE EVALUATION OF SPECKLE SUPPRESSION AND DATA COMPRESSION ALGORITHMS Final Report**
W. C. Huisman, W. Verhoef, and R. W. Okkes Paris, France ESA 16 Mar. 1986 75 p
(Contract ESA-5829/84-NL-BI(SC))
(NLR-TR-85085-L-Pt-3; ESA-CR(P)-2448-Vol-3; ETN-88-91147)
Avail: NTIS HC A04/MF A01

Rate distortion bounds for SAR images are compared with rate versus distortion relations obtained with speckle suppression and data compression algorithms. A method for optimally processing multispectral SAR-images is given. It uses the spectral correlation between the mean return power corresponding to each spectral channel. Real SAR-data is processed with the algorithms and subjected to information extraction experiments. Synthetic SAR-images can not efficiently be processed by the speckle suppression algorithm for one and four looks, if the goal is to obtain a least squares estimate of the reference image. For Seasat imagery (4 looks) data reduction with a compression ratio of 8, without speckle suppression, gives very acceptable results, with almost no impact on image segmentation for land scenes and on Fourier analysis for ocean scenes. The extraction of dominant ocean wave length and direction is not influenced by data compression and speckle suppression applied to Seasat data, even when the compression ratio is 20, and the appearance of Seasat imagery improves if speckle suppression is applied. ESA

**N88-14249#** National Aerospace Lab., Amsterdam (Netherlands). Space Div.
**STUDY OF SYNTHETIC APERTURE RADAR DATA COMPRESSION AND ENCODING. PART 4: ALGORITHM IMPLEMENTATION ASPECTS Final Report**
K. Hoffmann (Dornier-Werke G.m.b.H., Friedrichshafen, West Germany ) Paris, France ESA 15 Nov. 1985 31 p Prepared in cooperation with Dornier-Werke G.m.b.H., Friedrichshafen (West Germany)
(Contract ESA-5829/84-NL-BI(SC))
(NLR-TR-85085-L-Pt-4; ESA-CR(P)-2448-Vol-4; ETN-88-91148)
Avail: NTIS HC A03/MF A01

The investigations and trade-offs for on-board and ground implementation of speckle suppression and data compression algorithms are discussed. Onboard implementation is unsatisfactory due to high mass and power requirements. Dedicated hardware is recommended. Ground station needs can be met. The requirements for the data reduction part of the ground station are described and a processor architecture, which fulfills the speed requirements, is selected. ESA

**N88-14250#** Technical Univ. of Denmark, Lyngby.
**RESULTS ON THE LOW ELEVATION ANGLE PROPAGATION EXPERIMENT, PART 1 Final Report**
Torben Pedersen Paris, France ESA May 1987 190 p
(Contracts ESTEC-5480/83-NL-GM(SC);
ESTEC-5480/83-NL-GM(SC)-CCN-01)
(TUD-R-328; ESA-CR(P)-2462; ETN-88-91155) Avail: NTIS HC A09/MF A01

The impact of the lower troposphere on low elevation angle Earth-space links was studied. An X-band satellite beacon and 11 and 20 GHz radiometers conducted experiments using Intelsat V-5 at 12.5 deg elevation angle. Satellite failure led to use of Intelsat V-8 at 5 deg. Statistics on point rain rate at the receiver site, beacon attenuation, crosspolar discrimination, beacon fluctuation level (rms of scintillations), radiometric sky noise at the beacon frequency (11.2 GHz), and radiometric sky noise at 20 GHz are presented. ESA

**N88-14251#** National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
**FLIGHTPATH RECONSTRUCTION AND SYSTEMATIC RADAR ERROR ESTIMATION FROM MULTIRADAR RANGE-AZIMUTH MEASUREMENTS**
J. J. Renes, P. vandeKraan, and C. Eymann 19 Aug. 1985 8 p Presented at the 24th Conference on Decision and Control (CDC), Fort Lauderdale, Fla., 11-13 Dec. 1985 Previously announced in IAA as A86-42966
(Contract A0/12/AN/82)
(NLR-MP-85064-U; ETN-88-91326) Avail: NTIS HC A02/MF A01

The MURATREC facility for the off-line reconstruction of aircraft trajectories in an absolute reference frame, based on the processing of range and azimuth measurements of opportunity traffic in a multiradar environment is described. It comprises the estimation of systematic radar errors, their covariance matrix, and B-spline series approximating the reconstituted trajectories. The main algorithms are described. Results of validating MURATREC against high precision test flights are discussed. Absolute accuracies up to the radar resolution or better are obtained despite the error patterns that can occur in live radar data. ESA

**N88-14252#** Norges Tekniske Hoegskole, Trondheim. Electronics Research Lab.
**DOCUMENTATION OF COMPUTER PROGRAMS FOR OPTIMIZATION AND SIMULATION OF MULTICARRIER SAW-BASED DEMODULATOR**
P. M. Bakken and E. Lier Jan. 1986 50 p Sponsored by Royal Norwegian Council for Scientific and Industrial Research, Oslo Prepared in cooperation with Selskapet for Industriell og Teknisk Forskning, Trondheim, Norway
(PB87-134532; ISBN-82-595-4192; STF44-A86005) Avail: NTIS HC E04/MF E04 CSCL 17B

The report describes computer methods to optimize the receiver filter in a communication system when certain limitations on filter design are imposed. The method is applied to two designs of SAW-based multi-carrier demodulators where the receive filter impulse responses are limited in time duration. The optimization is carried out by a general optimization routine, while software has been developed to model the transmitted signal and the equivalent filter function of the SAW-based receiver. The results have been confirmed by simulation, and can be useful to a wide range of related problems (e.g., array antennas). GRA

**N88-14253#** Norges Tekniske Hoegskole, Trondheim. Electronics Research Lab.
**ADAPTIVE DIGITAL PHASE MODULATION**
T. Maseng and O. Trandem Jul. 1986 41 p Sponsored by Norwegian Telecommunications Administration Research Establishment, Kjeller Prepared in cooperation with Selskapet for Industriell og Teknisk Forskning, Trondheim, Norway
(PB87-134607; ISBN-82-595-4266-8; STF44-A86095) Avail: NTIS HC E04/MF E04 CSCL 17B

Experimental equipment for a Pan European digital mobile telephone system is being developed in several West European countries under the auspice of CEPT. The theoretical foundation for the Norwegian equipment is presented in this paper. The entire bandwidth of one channel is available to each user in a short time interval, thereby performing Time Division Multiple Access coding. During this time interval a preamble and modulated data is transmitted. Knowledge of the preamble enables the receiver to estimate the impulse response of the multipath channel. This is used to calculate metrics used by the Viterbi decoder which performs channel coding, demodulation, and equalizing. The transmitter and receiver structure is presented along with its performance. An attempt to clarify the compromise between burst rate, number of states, cell size and channel coding is made. GRA

**N88-14254#** Norges Tekniske Hoegskole, Trondheim. Electronics Research Lab.
**EIGENMODE ANALYSIS OF PARALLEL WAVEGUIDE COUPLERS**
A. Weierholt, A. Mickelson, and S. Neegard Aug. 1986 43 p Sponsored by Norwegian Telecommunications Administration Research Establishment, Kjeller and Royal Norwegian Council for Scientific and Industrial Research, Oslo Prepared in cooperation withSelskapet for Industriell og Teknisk Forskning
(PB87-132122; ISBN-82-595-4425-3; STF44-A86114) Avail: NTIS HC E04/MF E04 CSCL 20N

An analysis of a parallel waveguide structure has been carried out by using symmetric and antisymmetric eigenmodes in the coupled mode equations. As opposed to modes of each individual guide, eigenmodes are orthogonal and therefore comply with coupled mode formalism. In particular, interest has been devoted to the popular configuration: Z-cut LiNbO3 with wave propagation along the crystal Y-axis. The theory shows that output versus voltage characteristics are non-periodic in voltage, and furthermore, they are asymmetric if the eigenmodes are not equally excited. The uniform electrode coupler can easily be explained in terms of eigenmode coupling and interference. GRA

**N88-14255*#** Texas Univ., Austin. Electrical Engineering Research Lab.
**LAND MOBILE SATELLITE TRANSMISSION MEASUREMENTS AT 869 MHz. A COMPARISON OF ERROR PROBABILITIES FOR VARIOUS MESSAGE BLOCK DURATIONS AND FADE MARGINS AS A FUNCTION OF VEGETATION SHADOWING**
Wolfhard J. Vogel 25 Nov. 1985 49 p Prepared for JPL
(Contract JPL-956520)
(NASA-CR-179929; NAS 1.26:179929) Avail: NTIS HC A03/MF A01 CSCL 20N

In order to give vehicles travelling in rural areas of the U.S. access to the telephone network, a Land Mobile Satellite System is being planned. Previously presented data by the author were analyzed for the probability that the received signal level dropped below a threshold during short time blocks of various signal durations and the conditional probability that such an event would reoccur after a given delay. If it assumed that a fade threshold crossing of even 1 msec would produce an error in the transmission, then the derived quantities can be considered error probabilities. Extensive tables and graphs are presented with the results from the analysis. They can be used to devise communication strategies which will provide improved link availability in the presence of vegetation shadowing. Author

**N88-14256#** Maryland Univ., College Park. Inst. for Advanced Computer Studies.
**ON REAL-TIME SYSTEMS USING LOCAL AREA NETWORKS**
Shem-Tov Levi and Satish K. Tripathi Jul. 1987 39 p
(Contracts N00014-87-K-0124; N00014-87-K-0463)
(AD-A185475; UMIACS-TR-87-35; CS-TR-1892) Avail: NTIS HC A03/MF A01 CSCL 17B

The design and implementation of a real-time communication network has to be fault-free and timely, as defined by the applications served by this network. The time constraints of the applications are projected as stringent constraints on the local knowledge of time. However, the local knowledge of time in a distributed system requires the use of the communication network. The accuracy and coherence of this knowledge depend on how clocks are synchronized. Therefore, the performance of clock synchronization algorithms due to the communication network, is a good criterion for analyzing the adequacy of a particular network architecture to real-time application. This paper examines the adequacy of LAN architecture for real-time applications through a delay model of a typical LAN. The model is applied to various clock synchronization algorithms, and error estimates are derived. An efficient environment, in which the uncertainties in message communication elapsed time is significantly reduced, is then described for layered protocol architecture. In addition, it is shown that predictable communication elapsed time can be compensated for in synchronization algorithms, significantly reducing error. GRA

**N88-14257#** Defence Research Establishment, Ottawa. (Ontario).
**DISCUSSION ON THE MODELLING AND PROCESSING OF SIGNALS FROM AN ACOUSTO-OPTIC SPECTRUM ANALYZER**
Guy Farley Jun. 1987 46 p
(AD-A185639; DREO-TN-87-13) Avail: NTIS HC A03/MF A01 CSCL 17B

This report discusses the modeling of CW signals generated by an AcoustoOptic Spectrum Analyzer (AOSA). It also shows how this calculation can be related to pulse modulated signals. In its second part, it discusses the processing of those signals to detect and to estimate the carrier frequency and the power of an input radar signal. It also proposes a system block diagram to implement the former two functions. GRA

**N88-14258#** Naval Research Lab., Washington, D.C.
**FERROMAGNETIC MITIGATION OF ELECTROMAGNETIC PULSE EFFECTS**
W. G. Maisch, C. Vittoria, and V. J. Folen 8 Oct. 1987 24 p
(AD-A185685; NRL-MR-6099) Avail: NTIS HC A03/MF A01 CSCL 17B

A realistic description of EMP shielding by ferromagnetic materials was developed in this paper. The attenuation of three pulses by a typical ferromagnetic shield is described. Moreover, the form of this description readily allows for the inclusion of specific properties of ferromagnetic materials (e.g. magnetic relaxations, domain structure and magnetostriction) in calculations of shielding effectiveness. GRA

**N88-14259#** Pennsylvania Univ., Philadelphia. Dept. of Electrical Engineering and Science.
**STATISTICAL TECHNIQUES FOR SIGNAL PROCESSING Annual Interim Report, 1 Nov. 1985 - 31 Oct. 1986**
Saleem A. Kassam 20 Dec. 1986 7 p
(Contracts AF-AFOSR-82-0022; AF Proj. 2304)
(AD-A185774; AFOSR-87-1455TR) Avail: NTIS HC A02/MF A01 CSCL 17H

Summarized are research accomplishments in the 12 month period Nov. 1, 1985 to Oct. 31, 1986. Significant advances have been made in nonlinear filtering based on robust estimation, on nonparametric detection, and on a new noise model for signal-dependent and multiplicative noise. Reference is made to 11 publications. GRA

**N88-14260*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**SATELLITE GROUND-TERMINAL USER SIMULATION**
Mary Jo W. Shalkhauser Jan. 1988 15 p
(NASA-TM-100234; E-3859; NAS 1.15:100234) Avail: NTIS HC A03/MF A01 CSCL 17B

Realistic simulation of satellite communication systems and evaluation of satellite networking schemes require emulation of the systems's users. A laboratory model of a Ka-band satellite-switched time-division multiple-access (SS-TDMA) communication network, referred to as the System Integration, Test, and Evaluation (SITE) project, uses special bit-error-rate (BER) test sets to simulate the transmitting and receiving users of a communication network. The bit-error-rate test sets contain circuit boards that can be modified to create a variety of interfaces to satellite system ground terminals. Author

**N88-14261#** Technische Hogeschool, Delft (Netherlands). Afd. der Elektrotechniek.
**SPECTRAL- AND SPATIAL-DOMAIN FILTERING AND SAMPLING APPROACH TO THE NUMERICAL SOLUTION OF ELECTROMAGNETIC SCATTERING PROBLEMS**
R. W. C. vanderVeeken Oct. 1986 19 p
(PB88-106711; Rept-1986-15) Avail: NTIS HC A03/MF A01 CSCL 20N

A new systematic approach is developed for the numerical treatment of electromagnetic scattering problems. It employs a filtering and sampling procedure that is applied, alternately, to the spectral domain and spatial domain electromagnetic field representations. The resulting linear algebraic problem is solved by minimizing, iteratively, the root mean square value of the residual. Numerical results are obtained for the scattering by inhomogeneous, penetrable objects in one, two, and three dimensions. Author

**N88-14262#** Technische Hogeschool, Delft (Netherlands). Afd. der Elektrotechniek.
**STUDY OF EXTENDED LEAST-SQUARE ITERATIVE TECHNIQUES IN ELECTROMAGNETIC SCATTERING BY PENETRABLE OBJECTS**
R. W. C. vanderVeeken Jun. 1986 49 p
(PB88-105879; Rept-1986-8) Avail: NTIS HC A03/MF A01 CSCL 20N

The iterative computation of time harmonic electromagnetic fields scattered by arbitrarily shaped, inhomogeneous, transparent objects is investigated. The domain type integral equation is solved by minimizing iteratively a global root mean square error. Starting with an arbitrarily chosen initial estimate and employing different variational functions, a general, flexible, iterative procedure is developed in which a monotonic decrease in the error is enforced in each iteration step. Different interative schemes are obtained by employing different, suitable variational functions. Several typical schemes are compared numerically and numerical results are presented for one and two dimensional scattering problems. In the latter both TE and TM problems are investigated. Author

**N88-14263#** Technische Hogeschool, Delft (Netherlands). Afd. der Elektrotechniek.
**ELECTROMAGNETIC SCATTERING PROBLEM IN THE WAVE-VECTOR-TIME DOMAIN**
J. J. A. Klaasen Jan. 1987 84 p
(PB88-106083; Rept-1987-01) Avail: NTIS HC A05/MF A01 CSCL 20N

The general formulation of the three dimensional electromagnetic scattering problem is given in chapter 1, using the wave vector time domain formulation. Chapter 2 contains the basic three dimensional formulation of the electromagnetic scattering problem in the wave vector time domain, using so called contrast sources. In chapter 3, the three dimensional solution of the wave vector time domain is developed, using the marching-on-in-time method. In chapter 4, the one dimensional electromagnetic scattering problem is investigated, using the method developed in the previous chapters. The numerical

implementation of the one dimensional electromagnetic scattering problem is discussed in chapter 5. Numerical results of this one dimensional case are displayed also in chapter 5. Finally, some conclusions are given in chapter 6. Author

**N88-14555*#** Institute of Experimental Meteorology, Obninsk (USSR).
**THE CYCLONE METEOR RADAR SYSTEM FOR ROUTINE WIND MEASUREMENTS IN THE LOWER THERMOSPHERE**
I. A. Lysenko, P. P. Mikhailiek, and B. I. Petrov *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 376-380 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 17I

**N88-14556*#** Newcastle Univ. (Australia).
**THE NEWCASTLE METEOR RADAR**
Colin Keay *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 381-388 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 17I

**N88-14862*#** University of Southern Illinois, Carbondale. Dept. of Electrical Engineering.
**DIGITAL SIGNAL PROCESSING ALGORITHMS FOR AUTOMATIC VOICE RECOGNITION Final Report**
Nazeih M. Botros *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 20 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 17B

**N88-14870*#** New Mexico State Univ., Las Cruces. Dept. of Electrical and Computer Engineering.
**HIGH DATA RATE MODEM SIMULATION FOR THE SPACE STATION MULTIPLE-ACCESS COMMUNICATIONS SYSTEM Final Report**
Stephen Horan *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 19 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 19 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 17B

**N88-14883*#** Southern Univ., Baton Rouge, La. Coll. of Engineering.
**AUTOMATIC ANTENNA SWITCHING DESIGN FOR EXTRA VEHICULAR ACTIVITY (EVA) COMMUNICATION SYSTEM Final Report**
Manjit S. Randhawa *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 20 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 17B

# 33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

**N88-14264#** Helsinki Univ. of Technology, Espoo (Finland). Electronic Circuit Design Lab.
**HIGH FREQUENCY PERIODIC TIME DOMAIN WAVEFORM MEASUREMENT SYSTEM**
M. Sipilae and K. Lehtinen May 1987 19 p
(PB87-225256; Rept-1; ISBN-951-754-149-X) Avail: NTIS HC A03/MF A01 CSCL 09C

The theory is presented for a system designed for the accurate measurement of high frequency periodic time domain voltage and current waveforms of a nonlinear device. The measurements are performed in the time domain using a high speed sampling oscilloscope. The results are Fourier transformed into the frequency domain for error correction and then back to the time domain. An error correction algorithm is presented, enabling the obtaining of accurate waveforms in spite of nonideal system components. Practical difficulties in the measurement system characterization are also discussed. GRA

**N88-14265#** National Bureau of Standards, Washington, D.C. Electrosystems Div.
**RESEARCH FOR ELECTRIC ENERGY SYSTEMS Annual Report**
R. E. Hebner, ed. Sep. 1987 78 p
(Contract DE-AI01-87CE-34011)
(DE88-001733; NBSIR-87-3643) Avail: NTIS HC A05/MF A01

The technical progress in the five investigations which make up the project, Support of Research Projects for Electrical Energy Systems, is reported. To support the measurement of ions in the vicinity of dc transmission lines and in biological exposure facilities designed to simulate the line environment, techniques to measure ion mobility were evaluated. In addition, techniques were developed for biological researchers to use to determine the sensitivity of an AM radio to detect partial discharges in a biological exposure facility. A theoretical method was developed to evaluate the consistency among electron collision, transport, and dielectric strength data for binary gas mixtures. In addition, the gas phase hydrolysis rates for SOF2 and SOF4 at room temperature were measured; the corona discharge oxidation mechanisms were identified using prepared samples containing O(-16)2 and H2O(-16) or O(-18)2 and H2O(-18); and the role of SF negative ions on the SOF4 yield was also determined. Progress in the measurement of the electrical behavior at a liquid-solid interface included the optical measurement of the dynamic electrical field distribution as a streamer initiates. Progress in developing measurements for nanosecond dielectrics was made in characterization of the sources of error in the measurement of voltage pulses using E-dot probes, and the identification of the reduction of breakdown voltage in oil as the characteristic time of the voltage pulse is reduced. DOE

**N88-14266#** Lawrence Livermore National Lab., Calif.
**PICOSECOND CABLE CALIBRATOR: BEAM RESEARCH PROGRAM**
D. S. Donnelly Sep. 1987 37 p
(Contract W-7405-eng-48)
(DE88-002375; UCID-21217) Avail: NTIS HC A03/MF A01

The Picosecond Cable Calibrator is an instrument which accurately measures the electrical length (delay) of coaxial cables with a resolution of one picosecond. Other major features of the calibrator are: high accuracy, wide dynamic range; low cost; measurement simplicity; small size; single-ended cable access; and memory-stored substract. This paper provides a detailed description of performance characteristics; operating instructions; theory of operation; and maintenance. DOE

**N88-14267#** Chalmers Univ. of Technology, Goeteborg (Sweden). Space Observatory.
**LOW-FREQUENCY VLBI IN SPACE AND INTERSTELLAR REFRACTION**
B. Dennison and R. S. Booth Aug. 1986 13 p
(PB87-127643; Rept-86/46) Avail: NTIS HC E03/MF E01 CSCL 09C

The authors consider in some detail various technical considerations, including the decorrelating effects of the ionosphere and interplanetary medium, and conclude that low frequency very long baseline interferometry observations involving Quasat and Earth-based antennas would be feasible, particularly if sources are observed when they are in the anti-solar hemisphere. Author

**N88-14268#** United Nations Industrial Development Organization, Vienna (Austria).
**SELECTED ASPECTS OF MICROELECTRONICS TECHNOLOGY AND APPLICATIONS: NUMERICALLY CONTROLLED MACHINE TOOLS. TECHNOLOGY TRENDS SERIES NO. 2**
J. Sigurdson and J. Tagerud 26 May 1986 84 p Prepared in cooperation with Lund Observatory, Sweden
(PB87-132973; UNIDO/IS.632; V-86-56713) Avail: NTIS HC E05/MF A01 CSCL 09C

A UNIDO publication about machine tools with automatic control discusses the following: (1) numerical control (NC) machine tool perspectives, definition of NC, flexible manufacturing systems, robots and their industrial application, research and development, and sensors; (2) experience in developing a capability in NC machine tools; (3) policy issues; (4) procedures for retrieval of relevant documentation from data bases. Diagrams, statistics, bibliography are included. GRA

**N88-14269#** Science Research Council, Chilton (England).
**EDDY CURRENT SEMINAR, 24-26 MARCH 1986**
C. R. I. Emson 1986 229 p Seminar held 24-26 Mar. 1986
(PB87-124988; RAL-86-088) Avail: NTIS HC E11/MF E11 CSCL 09C

The following represents partial contents of the Eddy Current Seminar: nonlinear transient eddy current computation in three dimensions - project overview; error analysis in finite element models of electromagnetic fields; a finite element method for 3-D transient eddy current problems; the calculation of transient magnetic fields using the second order vector potential; transient 2-D analysis of synchronous machines; transient solution of switched devices; surface impedance methods for linear and nonlinear 2-D and 3-D problems; modeling eddy current problems; eddy currents and 3-D circuits; 3-D analysis of transformer leakage field and tank losses; a surface impedance boundary condition for 3-D nondestructive testing modeling. GRA

**N88-14270*** National Aeronautics and Space Administration. Pasadena Office, Calif.
**COAXIAL CABLE CONNECTOR Patent**
Edward R. Caro, inventor (to NASA) and Walter J. Bonazza, inventor (to NASA) (California Inst. of Tech., Pasadena.) 6 Oct. 1987 6 p Filed 8 Sep. 1986 Supersedes N87-15414 (25 - 07, p 896)
(NASA-Case-NPO-16764-1-CU; US-Patent-4,698,028; US-Patent-Appl-SN-904513; US-Patent-Class-439-271; US-Patent-Class-439-578) Avail: US Patent and Trademark Office CSCL 09A

A coaxial cable connector is provided, which resists radio frequency breakdown in coaxial cables used in the vacuum of outer space. The connector body surrounds an insulator which includes an easily compressible elastomeric portion. An insulated coaxial cable is prepared so that its insulation projects beyond the outer conductor and compresses the elastomeric portion of the connector insulator.
Official Gazette of the U.S. Patent and Trademark Office

**N88-14271*** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**INTEGRATED PHOTO-RESPONSIVE METAL OXIDE SEMICONDUCTOR CIRCUIT Patent**
Murzban D. Jhabvala, inventor (to NASA), David R. Dargo, inventor (to NASA), and John C. Lyons, inventor (to NASA) 24 Nov. 1987 8 p Filed 16 Jul. 1982 Supersedes N83-13360 (21 - 04, p 511
(NASA-Case-GSC-12782-1; US-Patent-4,709,252; US-Patent-Appl-SN-399074; US-Patent-Class-357-30; US-Patent-Class-357-231; US-Patent-Class-357-24; US-Patent-Class-357-30; US-Patent-Class-357-65; US-Patent-Class-357-56; US-Patent-Class-357-61) Avail: US Patent and Trademark Office CSCL 09C

An infrared photoresponsive element (RD) is monolithically integrated into a source follower circuit of a metal oxide semiconductor device by depositing a layer of a lead chalcogenide as a photoresistive element forming an ohmic bridge between two metallization strips serving as electrodes of the circuit. Voltage from the circuit varies in response to illumination of the layer by infrared radiation.
Official Gazette of the U.S. Patent and Trademark Office

**N88-14272#** Technische Univ., Brunswick (West Germany). Fakultaet fuer Maschinenbau und Elektrotechnik.
**A CONTRIBUTION TO THE REALIZATION OF ACTIVE FILTERS FOR HIGH FREQUENCY APPLICATIONS Ph.D. Thesis [EIN BEITRAG ZUR REALISIERUNG AKTIVER FILTER FUER ANWENDUNGEN BEI HOEHEREN FREQUENZEN]**
Gerhard Warmer 1986 196 p In GERMAN
(ETN-88-90811) Avail: NTIS HC A09/MF A01

Analog, active filters with operational amplifiers (op) were designed for applications at higher frequencies. The most important concepts for the design of active filters are discussed. It is explained how the effect of the nonideal op amplification on the two-terminal-network function can be reduced by suitable sizing and additional passive components. The properties of two-terminal networks consisting of cascade connections of resistances and supercapacitances, and of parallel-and cascade connections of capacitances and supercapacitances are discussed. A method for the analysis of a predistorted network and hence the realization of the required filter function is presented. A BASIC computer program for the analysis of a predistorted network using the embedding method was developed. Two realized practical filter circuits are presented. ESA

**N88-14273#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Product Assurance and Safety Dept.
**GENERIC SPECIFICATIONS FOR HYBRID MICROCIRCUITS**
Apr. 1987 58 p
(ESA-PSS-01-608-Iss-2; ISSN-0379-4059; ETN-88-91383)
Copyright Avail: NTIS HC A04/MF A01

The general requirements for circuit-type approval, procurement, lot-acceptance testing, and delivery of thick and thin film hybrid microcircuits suitable for space application are specified. It is used in conjunction with the detail specification applicable to the actual circuit type and is valid only for procurement from manufacturers whose capability is approved by ESA in accordance with specifications ESA PSS-01-605 or ESA PSS-01-606. ESA

**N88-14274#** Technische Hogeschool, Delft (Netherlands). Afdeling der Elektrotechniek.
**FINITE-ELEMENT METHOD FOR THREE-DIMENSIONAL ELECTRIC AND ELECTROMAGNETIC FIELD PROBLEMS**
H. J. Stam May 1986 34 p
(PB87-138731; REPT-1986-07) Avail: NTIS HC E03/MF E01 CSCL 20C

Finite-element methods are described that are especially suited for the computation of electric and electromagnetic fields in strongly inhomogeneous media. In both methods, expansion functions are used which guarantee a solution satisfying the continuity conditions at the interfaces between media having different properties. For

the electric current problem, this means that the continuity of the normal component of the electric current across faces of discontinuity in the electric properties of the medium is reinforced. For the electromagnetic field problem, the continuity of the tangential components of the electric field across faces of discontinuity in the electromagnetic properties of the medium is reinforced. For a simple configuration, numerical results are presented for the electromagnetic field problem. GRA

**N88-14275#** Rome Air Development Center, Griffiss AFB, N.Y.
**AN ANALYSIS OF SIMPLIFIED FEED ARCHITECTURES FOR MMIC (MONOLITHIC MICROWAVE INTEGRATED CIRCUIT) T/R (TRANSMIT/RECEIVE) MODULE ARRAYS**
J. Leon Poirier Feb. 1987 31 p
(AD-A185474; RADC-TR-86-236) Avail: NTIS HC A03/MF A01 CSCL 17I

MMIC T/R modules offer the possibility for simplifying the feed networks of active aperture phased arrays. In particular, the addition of amplitude control along with the existing phase control would allow the same feed network to be used in the transmit and receive modes even though the two require grossly different aperture tapers. This is easily accomplished by using the amplitude control in the modules to provide the weighting required to produce low sidelobe receive beams. Specific examples in which amplitude control is implemented with digital attenuators are examined. The effect of the attenuators on the array output signal-to-noise ratio and the error sidelobe level due to the amplitude quantization are evaluated. The results indicate that the component values needed - total attenuation 20 to 30 dB, low noise amplifier gains and noise figures 20 to 30 dB and 3 to 4 dB respectively, and quantization of 2 to 6 bits - are readily achievable in current GaAs technology. With these, active aperture monopulse arrays with sidelobe levels of -20 to -50 dB below the peak of the main beam may be designed with greatly simplified feed networks.
Author (GRA)

**N88-14276#** Stanford Univ., Calif. Dept. of Materials Science and Engineering.
**DC CONDUCTIVITY STUDIES IN LI5AIO4 AT INTERMEDIATE TEMPERATURES AND ITS POSSIBLE APPLICATION FOR THE ELECTROLYSIS OF WATER**
Steven Crouch-Baker, Lie-Yea Cheng, and Robert A. Huggins 30 Jul. 1987 3 p
(Contract N00014-84-K-0648)
(AD-A185489; TR-4) Avail: NTIS HC A02/MF A01 CSCL 07B

The results of DC conductivity experiments as intermediate temperatures on a material of initial composition Li5AI04 in various environments are reported. These results indicate that, under certain conditions, DC charge conduction in this system is due to the transport of hydroxide ions from the formation of LiOH. The possible application of this system for the electrolytic decomposition of water vapor is discussed. GRA

**N88-14277#** Harry Diamond Labs., Adelphi, Md.
**COMPUTER CALCULATIONS OF PIN DIODE LIMITER CHARACTERISTICS Interim Report, Oct. 1984 - Sep. 1985**
Alford L. Ward Sep. 1987 24 p
(DA Proj. 1L1-62120-A-140)
(AD-A185563; HDL-TR-2124) Avail: NTIS HC A03/MF A01 CSCL 09A

Characteristics of microwave limiters, especially those of spike leakage and burnout, although little understood, are of great importance to the high-power microwave community. The Harry Diamond Laboratories computer program DIODE has been used to simulate limiter action. This is the first time the basic physical mechanisms of a limiter diode have been studied by a computer program. Simulations have included silicon PIN diode widths of from 0.5 to 10 um, applied frequencies of 200 MHz to 50 GHz, and applied powers of 0.5 to 800 W. Illustrative carrier concentrations and electric fields are given as a function of distance across the diode and as a function of time, and diode and limiter output powers are given as a function of time. There is a frequency range where the limiter output power increases approximately linearly with frequency, which is the dependence predicted by linear theory. Avalanche breakdown during the reverse half-cycle is calculated for high-input powers. Limiter characteristics are shown to be strongly dependent upon diode temperature. calculations, limiter characteristics, silicon, forward bias, reverse switching, recombination lifetime, PIN diode and microwaves. GRA

**N88-14278#** Westinghouse Research and Development Center, Pittsburgh, Pa. Crystal and Device Research Dept.
**PROGRAM TO DEVELOPMENT AN OPTICAL TRANSISTOR AND SWITCH Final Report, 1 Sep. 1984 - 1 Mar. 1987**
T. Henningsen, M. Garbuny, and R. H. Hopkins 8 Jul. 1987 85 p
(Contract F49620-84-C-0103)
(AD-A185666; Rept-87-9F4-NUTRN-R1; AFOSR-87-1309TR)
Avail: NTIS HC A05/MF A01 CSCL 09E

The Optical Transistor and Switch, for which concepts and designs were developed under this program, is a device in which a radiation beam of one wavelength is controlled by a beam of a second wavelength. In contrast to other optical transistors and switches, this arrangement keeps the requirements for control and signal independent and thus adds another dimension to design. The basic device provides simply an optical path through a medium which consists of of free three-energy level atoms such as sodium vapor at very low pressures. It provides, with relatively low optical powers, satisfactory switching action and transistor saturation gains of 3-10. A subsequent concept is that of Multistate Optical Transistors based on spectroscopically complementary materials. Very high transistor gains can be achieved with two variations of this concept. However, the higher optical power demand and the stringent requirement of double resonance between two materials are important drawbacks. The third concept is the Quantum Transition Etalon (QTE), which consists of a Fabry-Perot cavity enclosing the three-level medium. The QTE appears to have substantially the advantages of the two former concepts, but none of their limitations. GRA

**N88-14279#** Stanford Univ., Calif. Dept. of Materials Science and Engineering.
**CONDUCTIVITY STUDIES ON HYDROXIDE ION CONDUCTORS IN THE LI-AI-O-H SYSTEM AT INTERMEDIATE TEMPERATURES**
Lie-Yea Cheng, Steven Crouch-Baker, and Robert A. Huggins 30 Jul. 1987 3 p
(Contract N00014-84-K-0648)
(AD-A185714; TR-6) Avail: NTIS HC A02/MF A01 CSCL 07D

DC conductivity studies on a material of nominal composition Li5a104 in a wet environment at intermediate temperatures have been interpreted in terms of hydroxide ion conduction, leading to the possibility of using Li5A104 should show similar behavior. In this work, the results of DC conductivity measurements on several compositions in the Li-A1-O-H system are reported. GRA

**N88-14280#** Stanford Univ., Calif. Dept. of Materials Science and Engineering.
**PHASE BEHAVIOR IN THE LI-AI-O-H SYSTEM AT INTERMEDIATE TEMPERATURES**
Steven Crouch-Baker and Robert A. Huggins 30 Jul. 1987 3 p
(Contract N00014-84-K-0648)
(AD-A185732; TR-3) Avail: NTIS HC A02/MF A01 CSCL 07D

It has been demonstrated that a material of initial composition Li5AlO4 will, in a wet environment, support continuous direct current in the presence of platinum electrodes at intermediate temperatures. This has been attributed to the conduction of hydroxide ions derived from the formation of Lithium hydroxide. The observed behavior in this system is discussed with reference to the calulated Lithium aluminum hydroxide phase diagram.
GRA

**N88-14281#** Naval Ship Research and Development Center, Annapolis, Md. Propulsion and Auxiliary Systems Dept.
**THE USE OF ALLOY 117 AS A LIQUID METAL CURRENT COLLECTOR Research and Development Report, Jan. - Mar. 1986**
David Maribo and Neal Sondergaard Sep. 1987 19 p
(AD-A185740; DTNSRDC-PAS-87-06) Avail: NTIS HC A03/MF A01 CSCL 09A

Low melting point, bismuth based alloys are potential replacements for NaK78 as liquid metal slip ring material because of their lower reactivity and potentially greater hydrodynamic stability. This paper describes experiments with one such alloy in a model of a 300 kW superconducting homopolar motor using close clearance braid type collectors. Slip ring tip velocities varied from 5 to 20 m/s and currents ranging from 500 to 2000 A. Viscous power losses tend to follow a simple turbulent mode. In all, the data supports the use of low melting point alloys as an alternative to Na78. GRA

**N88-14860*#** Louisiana Tech Univ., Ruston. Dept. of Electrical Engineering.
**MATHEMATICAL MODEL FOR THE dc-ac INVERTER FOR THE SPACE SHUTTLE Final Report**
Frederick C. Berry *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 20 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 09C

**N88-14869*#** Texas A&M Univ., Galveston. Dept. of Marine Science.
**POWER AND CHARGE DISSIPATION FROM AN ELECTRODYNAMIC TETHER Final Report**
Gerald E. Hite *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 20 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 09C

# 34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

**N88-14282#** Helsinki Univ. of Technology, Espoo (Finland). Dept. of Mechanical Engineering.
**DESCRIPTION AND ANALYSIS OF A CASCADE CONTROL OF FLUID FLOW**
M. J. Lampinen, H. T. Toivonen, E. J. Niskanen, and A. Kaerkkaeinen 1986 28 p
(PB87-112686; Rept-20) Avail: NTIS HC E03/MF E01 CSCL 20D

A new invention, called the cascade control of fluid flow, is described and analyzed. The main idea of this control method is that the flow can be kept constant at varying pressure differences by using the existing pressure difference over the control valve as an energy source for making adjustments. Some technical limits for the applicability of the method are discussed. A theoretical consideration of a servocontrol system, where the desired volume flow is changed by external control, is also presented. Author

**N88-14283*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**NUMERICAL SIMULATION OF BOUNDARY LAYERS. PART 3: TURBULENCE AND RELAMINARIZATION IN SINK FLOWS**
Philippe R. Spalart Feb. 1986 30 p Submitted for publication
(NASA-TM-88220; A-86073; NAS 1.15:88220) Avail: NTIS HC A03/MF A01 CSCL 20D

Direct numerical simulations of sink-flow boundary layers, with acceleration parameters K between 1.5 and 3.0 x 10 to the -6 power, are presented. The three-dimensional, time-dependent Navier-Stokes equations are solved numerically using a spectral method, with about 10 to the -6 degrees of freedom. The flow is assumed to be statistically steady, and self-similar. A multiple-scale approximation and periodic conditions are applied to the fluctuations. The turbulence is studied using instantaneous and statistical results. Good agreement with the experiments of Jones and Launder is observed. Two effects of the favorable pressure gradient are to extend the logarithmic layer, and to alter the energy balance of the turbulence near the edge of the boundary layer. At very low Reynolds number the logarithmic layer is shortened and slightly displaced, but wall-layer streaks are present even at the lowest values of the Reynolds number for which turbulence can be sustained. Large quiescent patches appear in the flow. Relaminarization occurs at K = 3.0 x 10 to the -6 power, corresponding to a Reynolds number, based on momentum thickness, of about 330. Author

**N88-14284#** Technische Hogeschool, Delft (Netherlands). Onderafdeling der Wiskunde en Informatica.
**VECTORIZATION OF A MULTIGRID METHOD FOR THE COMPRESSIBLE NAVIER-STOKES EQUATIONS**
G. Shaw and P. Wesseling [1986] 20 p
(PB87-230496; Rept-86-14) Copyright Avail: NTIS HC A03/MF A01 CSCL 20D

An efficient multigrid method for the solution of the compressible Navier-Stokes equations was described. This algorithm was designed such that the resulting computer program was readily amenable to vectorization. The subsequent process of vectorization is described giving comparisons of scalar and vector timings on a CRAY-1S. Of particular interest is the vectorization of the Van Leer flux splitting method, the implementation of which constitutes one of the most time consuming elements in the algorithm. The program is found to run approximately three times faster in vector mode than in scalar mode. Author

**N88-14285#** Sandia National Labs., Albuquerque, N. Mex.
**AN EVALUATION OF A TRANSLATOR FOR FINITE ELEMENT DATA TO RESISTOR/CAPACITOR DATA FOR THE HEAT DIFFUSION EQUATION**
1987 16 p Presented at the Symposium on Technology of Glass, Ceramic, or Glass-Ceramic to Metal Sealing, Boston, Mass., 3 Dec. 1987
(Contract DE-AC04-76DP-00789)
(DE87-013926; SAND-87-2023C; CONF-871207-13) Avail: NTIS HC A02/MF A01

This paper evaluates a translator for finite element data to resistor/capacitor data (FEM/RC) for the numerical solution of heat diffusion problems. The translator involves the derivation of thermal resistors and capacitors, implicit in the heat balance formulation of the finite difference method. It uses a finite element mesh, which consists of nodes and elements and is implicit in the Galerkin finite element method (GFEM). This hybrid translation method, FEM/RC, has been incorporated in Q/TRAN, a new Q/TRAN, HEATING-6, and a research code employing GFEM on a purely mathematical, highly nonlinear steady-state conduction benchmark problem. The evaluation concludes that the FEM/RC technique has numerical characteristics that are consistent with comparable schemes for the benchmark problem. FEM/RC also accurately translates skewed meshes. Because FEM/RC generates resistors and capacitors, it appears to offer a more computationally efficient method than the classical GFEM. DOE

**N88-14286#** Illinois Univ., Chicago. Dept. of Chemical Engineering.
**HEAT TRANSFER INVESTIGATIONS IN A SLURRY BUBBLE COLUMN Quarterly Report, Jul. - Sep. 1987**
S. C. Saxena, R. Vadivel, and S. Zhou 1987 28 p
(Contract DE-AC22-86PC-90008)
(DE88-001445; DOE/PC-90008/T1) Avail: NTIS HC A03/MF A01

Discussed are the fabrication and installation of the 10.8 cm internal diameter Plexiglas slurry bubble column as well as of the associated gas and slurry flow loops. The heat transfer probes together with its power supply system, and temperature measurement circuit as well as details of this facility and the results of some of the preliminary test runs completed to date are described. Substantial design and partial fabrication of the 30.5 cm diameter pyrex glass slurry bubble column has been completed, and many components required to complete the remaining parts of the system are under order. Review and collection of the literature dealing with the hydrodynamics and heat transfer in two- and three-phase slurry bubble columns has been initiated. DOE

**N88-14287#** Rensselaer Polytechnic Inst., Troy, N.Y.
**INTERNATIONAL WORKSHOP ON TWO-PHASE FLOW FUNDAMENTALS**
R. T. Wood, ed. Oct. 1987 225 p Presented at the Department of Energy International Workshop on Two-Phase Flow Fundamentals, Troy, N.Y., 16 Mar. 1987 Prepared in cooperation with Electric Power Research Inst., Palo Alto, Calif.
(Contract DE-FG02-86ER-13637; EPRI Proj. RP-8006-8)
(DE88-001478; CONF-870320) Avail: NTIS HC A10/MF A01

The objectives of this Workshop on two-phase flow and heat transfer phenomena were to reach agreement on future research. The results of an extensive Physical and Numerical Benchmark Exercise were presented at the Workshop held at Rensselaer Polytechnic Institute (RPI). It was shown that, while numerical methods exist with which to evaluate both one-dimensional and multidimensional two-phase flows, current analytical models are often inadequate. In particular, it was demonstrated that no preferred general closure laws exist for two-fluid models of two-phase flow. Several lectures summarized the state-of-the-art in two fluid modeling, numerical methods and two-phase instrumentation and experimental techniques. These talks stressed that there is uncertainty in the ability to model interfacial transfers and that the instrumentation needed for the measurement of many key parameters often does not exist. In anticipation of the need to further assess two fluid models of two-phase flow various new benchmark data sets were discussed and selected. Significantly, some of these data sets highlight multidimensional aspects of two-phase flow, while in others nonequilibrium phenomena are significant. The Workshop was evaluated by a distinguished panel that comprised an Evaluation Committee. Their report is given in this report. DOE

**N88-14288#** Battelle Columbus Labs., Ohio.
**ADVANCED CONDENSING HEAT EXCHANGERS Annual Report**
G. H. Stickford, S. G. Talbert, A. K. Agrawal, B. Hindin, M. J. Murphy, D. W. Locklin, D. Bigg, and E. D. Spinosa Jan. 1987 141 p
(Contract DE-AC02-76CH-00016)
(DE88-001485; BNL-52080) Avail: NTIS HC A07/MF A01

This report presents the results of the first year of a research program Battelle is conducting for the Brookhaven National Laboratory. The primary objectives of this program are to resolve the major technical problems which may limit the performance and service life of high efficiency, condensing appliances, and to transfer this technology to the furnace and boiler manufacturing industry. DOE

**N88-14289#** Lawrence Livermore National Lab., Calif.
**MODEL DEVELOPMENT FOR INDUCTION HEATING**
P. M. Gresho Aug. 1987 17 p
(Contract W-7405-eng-48)
(DE88-002376; UCID-21154) Avail: NTIS HC A03/MF A01

The simulation tools for modeling the fluid mechanics in the melt and the heat transfer in and around the melt, while far more complex than that required to determine the power input to the crucible, will be subjects of other reports. Herein we focus on the single question: what is the spatial (and temporal if relevant) distribution of power generation in the metal crucible. DOE

**N88-14290#** Lawrence Livermore National Lab., Calif.
**BUBBLE EXPANSION AND COLLAPSE STUDIES Annual Report, FY87**
T. A. Reitter, ed. 28 Aug. 1987 75 p
(Contract W-7405-eng-48)
(DE88-002377; UCID-21175) Avail: NTIS HC A04/MF A01

The literature has been surveyed and one-dimensional (1-D) and two-dimensional (2-D) calculations performed of bubble expansion and collapse in water. Despite an extensive literature, there is one case of direct comparison of experimental data and calculations. The 2-D calculations of bubble expansion and collapse near a wall, using four different hydrodynamics codes, have revealed the difficulties of calculating a problem characterized by many weak shocks and a long period of relatively small changes, preceded and followed by short periods of rapid change and large distortions. It is concluded that experimental data collected for the purpose of code improvements are necessary, and that new calculational tools are also necessary for improved understanding of the behavior of collapsing bubbles. DOE

**N88-14291#** Mitsubishi Heavy-Industries Ltd., Tokyo (Japan).
**STUDIES ON FLUID-STRUCTURAL VIBRATION USING BOUNDARY ELEMENT METHOD**
K. Ohta, I. Honda, K. Kagawa, T. Hara, and K. Yanagi 1986 16 p
(PB87-129508; MTB-172) Avail: NTIS HC E03/MF E01 CSCL 20D

The numerical method for solving the fluid structure interactive vibration of a 3 dimensional structure with complicated configurations such as ship structures, offshore structures and so on are presented. This numerical approach was applied to the several dynamic problems obtaining good agreement with the theoretical or experimental results, proving the effectiveness and availability of this method. A newly developed vibration analysis procedure for interactive systems is presented. The procedure uses modal analysis techniques to combine the added mass matrix of fluid which is calculated by the boundary element method with the dynamic characteristics of structure which are obtained experimentally or by calculation using a general structural analysis program. Also suggested is an overlapping method to calculate efficiently the added mass matrix of slender structures as ships. The method divides the fluid boundary into several sections with overlapped portion, calculate the added mass matrix of each section and sums up these added mass matrix to construct that of a whole system. Author

**N88-14292** Michigan Univ., Ann Arbor.
**THEORETICAL AND NUMERICAL ANALYSIS OF SHOCK WAVE PROPAGATION THROUGH DIFFERENT DUSTY-GAS MIXTURE LAYERS Ph.D. Thesis**
Fu-Long Chang 1987 150 p
Avail: Univ. Microfilms Order No. DA8720252

Two phase dusty-gas shock wave propagation through regions of nonuniform particle loading is studied theoretically and numerically. Two problems were investigated: the first is that of a dusty-gas shock reflected from a rigid wall and the second is that of a dusty-gas shock passing through regions of nonunifrom dust loading. In the numerical approach, a method based on the Roe and backward difference schemes were developed to solve the one dimensional unsteady dusty-gas flow equations providing smoother solutions than previous numerical studies. Using an analytical approach, based on equilibrium flow theory, the study state flow structure was found and compared to the numerically computed structure to provide partial validation for the numerical

calculations. To find the transmitted shock strength for a dusty-gas shock propagation through a region of nonuniform dust loading, a linearized method and an iterative (exact) method, which was used in the pure gaseous case, were extended and applied to the dusty-gas mixture flows. Also, based on the iterative method, it was possible to prove that when the dust loading ahead of the dusty-gas shock becomes infinite the problem of shock propagation becomes identical to the shock refelction problem, thus providing a connection between the interface and reflection problems.
Dissert. Abstr.

**N88-14293** Texas A&M Univ., College Station.
**AN INVESTIGATION OF THE EFFECTS OF THE PROPELLER SLIPSTREAM ON A WING BOUNDARY LAYER Ph.D. Thesis**
Richard Moore Howard 1987 134 p
Avail: Univ. Microfilms Order No. DA8720903

The behavior of a wing boundary layer immersed in a propeller slipstream has been studied experimentally. Airfoil surface static pressure measurements were made for time-averaged effects, and time-dependent measurements were made with hot-film anemometer sensors for the determination of instantaneous velocities. Vertical boundary layer traverses were made at fixed chord locations for the determination of velocity profiles and for values of the turbulence intensity. The boundary layer has a coherent, time-dependent cycle of transitional behavior, varying from laminar to turbulent. This layer shows similarities to those disturbed by high levels of external flow turbulence and to those in a relaminarizing environment. Profile drag coefficients determined from the time-dependent ensemble-average velocity profiles for the freewheeling propeller case show the drag in the propeller slipstream varies from the undisturbed laminar value to a value less than that predicted for fully turbulent flow. Drag values determined from the low Reynolds number thrusting propeller case in the wind tunnel show that the effects of the slipstream are to enhance the stability of the boundary layer and to reduce the drag coefficient in the laminar portion of the slipstream cycle below its undisturbed value.
Dissert. Abstr.

**N88-14294** California Inst. of Tech., Pasadena.
**EXPERIMENTAL INVESTIGATION OF HETEROGENEOUS COMPRESSIBLE SHEAR LAYERS Ph.D. Thesis**
Dimitri Papamoschou [1987] 179 p
Avail: Univ. Microfilms Order No. DA8719691

A compressible, two-dimensional shear layer is investigated experimentally in a novel facility. In this facility it is possible to flow similar or dissimilar gases of different densities and to select different Mach numbers for each stream over a wide range of Reynolds numbers. Ten combinations of gases and Mach numbers are studied in which the freestream Mach numbers range from 0.2 to 4, the density ratio varies from 0.2 to 9.2, and the velocity ratio varies from 0.13 to 1. The growth of the turbulent region of the layer is measured by means of pitot pressure profiles obtained at several streamwise locations. The transition from laminar to turbulent flow, as well as the structure of the turbulent layer, are observed with Schlieren photographs of 20 nanosecond exposure. A compressibility effect parameter is defined that correlates and unifies the experimental results.
Dissert. Abstr.

**N88-14295** California Inst. of Tech., Pasadena.
**AN EXPERIMENTAL AND NUMERICAL INVESTIGATION OF SWIRLING FLOWS IN A RECTANGULAR NOZZLE Ph.D. Thesis**
Thomas Henry Sobota [1987] 168 p
Avail: Univ. Microfilms Order No. DA8719706

The high thrust to weight ratios now possible for military aircraft have made thrust vector pitch control more attractive and versatile than aerodynamic surface pitch control. Use of a rectangular nozzle is a natural consequence because articulation and sealing problems are less formidable than for conventional circular ones. The rectangular nozzle offers the additional possibility that the exhaust may mix rapidly with the ambient air and thereby reduce the radiative signature of the exhaust. A detailed experimental investigation is described, which demonstrates that the formation of axial vortices in the nozzle is dependent on the vorticity distribution at the turbine exhaust. Further, three mechanisms which provide for the formation of axial vortices are identified. A parallel computational investigation was carried out which not only confirmed the relationship between the turbine exhaust vorticity and the vortex pattern formed in the nozzle but also provided details of the flow field between the turbine discharge and the nozzle exit. On the basis of this more detailed understanding, it is now possible to tailor the vortex distribution at the nozzle exit by design of the turbine discharge and the intervening passage.
Dissert. Abstr.

**N88-14296** Texas A&M Univ., College Station.
**EXTENSIONS OF THE CONTROL VOLUME BASED FINITE ELEMENT METHOD FOR FLUID FLOW PROBLEMS Ph.D. Thesis**
Syed Rahmat Husain [1987] 148 p
Avail: Univ. Microfilms Order No. DA8720907

The Control Volume Based Finite Element Method (CVFEM) has been extended in two main aspects. The first is the integration of the vorticity-streamfunction formulation with the CVFEM. The key contribution of this work is the formulation of the wall vorticity which allows successful modeling of fluid flow problems with irregular boundaries. The resulting algorithm exhibits the desirable qualities of consistency, accuracy and stability. The second extension is the use of the standard two-equation kappa-epsilon turbulence transport model in conjunction with the equal-order version of the CVFEM for turbulent fluid flow problems. The numerical results are realistic and encouraging, thereby laying the groundwork for more sophisticated turbulence models.
Dissert. Abstr.

**N88-14297** Stanford Univ., Calif.
**DUAL CYLINDRICAL WAVE LASER-DOPPLER METHOD FOR MEASUREMENT OF SKIN FRICTION IN FLUID FLOW Ph.D. Thesis**
Amir Ahmad Naqwi [1987] 280 p
Avail: Univ. Microfilms Order No. DA8720421

An instrument was developed for measurement of the instantaneous velocity gradient in a boundary layer at a solid surface. The principle of the device is akin to that of a dual-beam Laser Doppler Anemometer. The present technique uses interference between two closely spaced cylindrical waves emanating from the solid surface. The interference fringes which constitute the measuring volume appear to be radiating from a point on the surface. Seed particles in the fluid scatter light while crossing the measuring volume. The scattered light is collected and analyzed in a conventional manner. This device was tested in laminar and turbulent water flow. The data for turbulent flow include measurement of mean skin friction, wall turbulence intensity, skewness and flatness factors of near-wall turbulence, and the probability density function of skin friction. These parameters are also reported for spanwise fluctuations. All the data were obtained from a flat-plate boundary layer having a Reynolds number of approximately 3700 based on momentum thickness.
Dissert. Abstr.

**N88-14298** Wichita State Univ., Kans.
**COMPUTATION OF TURBULENT FLOW OF AIR THROUGH SMOOTH AND ROUGH PIPES USING A TWO-EQUATION TURBULENCE MODEL Ph.D. Thesis**
Nuri Zeytinoglu [1987] 143 p
Avail: Univ. Microfilms Order No. DA8720645

A computational method is developed to calculate fully developed and developing turbulent flow fields through smooth and rough pipes using a two-equation turbulence model. The flow in the duct is partitioned into finite streams. The difference equations are then obtained by applying conservation principles directly to the individual streams. A Two-Equation turbulence model (kappa-epsilon) is used in conjunction with the wall function formulas. The wall functions for the mass, momentum, enthalpy, turbulent kinetic energy and dissipation rate are derived for both smooth and rough pipes. Roughness effects are accounted by

inserting a form drag term in the momentum equation, a source term in the enthalpy equation, and an additional generation term in the turbulent kinetic energy equation. The results of this study are in good agreement with available experimental and analytical data for smooth and rough pipes. Dissert. Abstr.

**N88-14299*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**FLIGHT AND WIND-TUNNEL MEASUREMENTS SHOWING BASE DRAG REDUCTION PROVIDED BY A TRAILING DISK FOR HIGH REYNOLDS NUMBER TURBULENT FLOW FOR SUBSONIC AND TRANSONIC MACH NUMBERS**
Sheryll Goecke Powers, Jarrett K. Huffman, and Charles H. Fox, Jr. (National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.) Nov. 1986 143 p
(NASA-TP-2638; H-1281; NAS 1.60:2638) Avail: NTIS HC A07/MF A01 CSCL 20D

The effectiveness of a trailing disk, or trapped vortex concept, in reducing the base drag of a large body of revolution was studied from measurements made both in flight and in a wind tunnel. Pressure data obtained for the flight experiment, and both pressure and force balance data were obtained for the wind tunnel experiment. The flight test also included data obtained from a hemispherical base. The experiment demonstrated the significant base drag reduction capability of the trailing disk to Mach 0.93 and to Reynolds numbers up to 80 times greater than for earlier studies. For the trailing disk data from the flight experiment, the maximum decrease in base drag ranged form 0.08 to 0.07 as Mach number increased from 0.70 to 0.93. Aircraft angles of attack ranged from 3.9 to 6.6 deg for the flight data. For the trailing disk data from the wind tunnel experiment, the maximum decrease in base and total drag ranged from 0.08 to 0.05 for the approximately 0 deg angle of attack data as Mach number increased from 0.30 to 0.82. Author

**N88-14300#** Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
**INTRODUCTION TO COMPUTATIONAL FLUID DYNAMICS**
1987 357 p Lecture series held in Rhode-Saint-Genese, Belgium, 2-6 Feb. 1987
(VKI-LS-1987-02; ISSN-0377-8312; ETN-88-91159) Avail: NTIS HC A16/MF A01

Solutions of boundary layer equations, finite element techniques, and implicit time dependent methods are discussed. For individual titles, see N88-14301 through N88-14304.

**N88-14301#** Maryland Univ., College Park. Dept. of Aerospace Engineering.
**INTRODUCTION**
John D. Anderson, Jr. *In* Von Karman Inst. for Fluid Dynamics, Introduction to Computational Fluid Dynamics 1987 269 p (For primary document see N88-14300 06-34)
Avail: NTIS HC A16/MF A01

A tutorial description of computational fluid dynamics is presented. It is aimed at students with little experience at an undergraduate level. Definitions are given and the solution of the partial differential equation systems is discussed. The discretization processes for finite element procedures are described. ESA

**N88-14302#** Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
**BOUNDARY LAYER EQUATIONS AND METHODS OF SOLUTION**
Roger Grundmann *In its* Introduction to Computational Fluid Dynamics 1987 30 p (For primary document see N88-14300 06-34)
Avail: NTIS HC A16/MF A01

The boundary layer theory is described. The hierarchy of boundary layer equations is discussed. The relationship of the different types of boundary layer equations to the Navier-Stokes equation is demonstrated. It is pointed out that there are transformation techniques to reduce the problems of solution. A generalized discretization scheme is applied to a set of laminar compressible boundary layer equations and a numerical solution scheme for calculating the remaining tridiagonal linear difference equations is shown. ESA

**N88-14303#** University Coll. of Swansea (Wales).
**FINITE ELEMENT TECHNIQUES**
C. Taylor *In* Von Karman Inst. for Fluid Dynamics, Introduction to Computational Fluid Dynamics 1987 39 p (For primary document see N88-14300 06-34)
Avail: NTIS HC A16/MF A01

The finite element method is explained. The method of weighted residuals, shape functions, a general theory of spatial discretization, matrix formulation of flow equations, and applications to laminar flow and turbulent flow are covered. ESA

**N88-14304#** Sherbrooke Univ. (Quebec). Dept. of Mechanical Engineering.
**IMPLICIT TIME DEPENDENT METHODS FOR INVISCID AND VISCOUS COMPRESSIBLE FLOWS**
Gerard Degrez *In* Von Karman Inst. for Fluid Dynamics, Introduction to Computational Fluid Dynamics 1987 100 p (For primary document see N88-14300 06-34)
Avail: NTIS HC A16/MF A01

The properties of inviscid and viscous compressible flow equations are reviewed. The stability properties of explicit and implicit time dependent methods are studied on simple test cases to show the advantage of implicit methods with respect to explicit methods. Implicit time dependent methods are analyzed. Flux splitting relaxation methods are shown to have the best convergence properties for infinite time step. ESA

**N88-14305#** Technische Univ., Brunswick (West Germany). Fakultaet fuer Maschinenbau und Elektrotechnik.
**A DIRECT CALCULATION METHOD FOR PERTURBATION FIELDS OF MOVING BODIES IN COMPRESSIBLE MEDIA AT SUBSONIC MACH NUMBERS Ph.D. Thesis [ENTWURF, HERSTELLUNG UND CHARAKTERISIERUNG BREITBANDIGER LICHTWELLENLEITER]**
Holger Karstensen 1986 188 p In GERMAN
(ETN-88-90808) Avail: NTIS HC A09/MF A01

A panel method for the calculation of three-dimensional, steady, compressible subsonic flows was developed, on the basis of an existing panel method of first order and Mach-number-dependent influence factors from the literature. The factors take into account the real perturbation quantities in compressible flows that are induced by singularities in a field point and that are changed in comparison with the imcompressible case. This procedure allows to fulfil the correct kinematic flow condition directly at the original body. A comparison between the results, obtained with this linearized theory, and measured data as well as results of difference methods, indicates the domain of validity of this linearized theory. The difference with the solution of the linearized potential equation using the Gothert rule is explained. Good agreement between the developed method and the completely nonlinear theory is found for pure subsonic flow. ESA

**N88-14306#** Technische Univ., Brunswick (West Germany). Fakultaet fuer Maschinenbau und Elektrotechnik.
**APPROXIMATE SOLUTIONS FOR THE MOMENTUM TRANSPORT IN TURBULENT FLOWS IN NARROW ROD ARRAY BUNDLES USING THE FINITE ELEMENT METHOD Ph.D. Thesis [NAEHERUNGSLOESUNGEN FUER DEN IMPULSTRANSPORT BEI TURBULENTER STROEMUNG IN ENGEN STABGITTER-BUENDELN NACH DER METHODE DER FINITEN ELEMENTE]**
Hans-Georg Kaiser 1985 173 p In GERMAN
(ETN-88-90810) Avail: NTIS HC A08/MF A01

A method was developed for the calculation of turbulent flows in larger, connected rod arrays with small rod distances, with a view to the design of rod array bundle with turbulent flow. The mathematical formulation of the flow phenomena in incompressible, isothermal flows, and the modeling of turbulence properties are presented. A novel algebraic turbulence model is explained. The

finite element method as a numerical solution method, and the construction of the grid are presented. The comparison with measured channel flows show that the accuracy of the simulation is sufficient for technical requirements and that the high vortex viscosity parallel to the wall is a very essential parameter for the determination of the azimuthal momentum transfer. In the domain of small rod distances the method is superior to the existing one. ESA

**N88-14307#** Technische Hogeschool, Eindhoven (Netherlands).
**FLOW INDUCED PULSATIONS IN PIPE SYSTEMS Ph.D. Thesis**
Jan Cornelis Bruggeman 1987 164 p
(ETN-88-91367) Avail: NTIS HC A08/MF A01

The aeroacoustic behavior of a low Mach number, high Reynolds number flow through a pipe with closed side branches was investigated. Sound is generated by coherent structures of concentrated vorticity formed periodically in the separated flow in the T-shaped junctions of side branches and the main pipe. The case of moderate pulsation amplitudes was investigated. It appears that the vortical flow in a T-joint is an aeroacoustic source of constant strength when acoustic energy losses due to radiation and friction are small but not negligible. When acoustic energy losses due to radiation and friction are negligible, the nonlinear character of vortex damping is the amplitude limiting mechanism. It is stressed that aeroacoustic sources should not be neglected in studies of the response of a piping lay-out with flow to, e.g., the pulsating output of a compressor. ESA

**N88-14308#** Instituut TNO voor Werktuigkundige Constructies, Delft (Netherlands).
**VALIDATION OF THE UNDERWATER SHOCK ANALYSIS (USA) PROGRAM. PART 1: THEORETICAL CONSIDERATIONS**
J. P. Pauwelussen Feb. 1986 78 p
(Contract RDO-TNO-70/KM/124)
(Rept-5073713-86-01; ETN-88-91715) Avail: NTIS HC A05/MF A01

The theoretical basics of fluid-structure interaction code Underwater Shock Analysis (USA) are discussed and the doubly asymptotic approximation method used in the USA-code to approximate the fluid from its high and low frequency characteristics is examined. The use of boundary elements instead of finite elements makes the code very efficient with respect to computer time. The computational strategy of the staggered partition method saves CPU as compared to other solution methods. The unconditional stability of this partition method makes the USA code useful for applications with problems with a wide frequency range (as for shocks). Though the USA results look statisfactory for a sphere or cylinder, more general geometries as for example a submerged ellipsoid, may lead to larger errors. A second shortcoming is the lack of ability to model reflections between two submerged bodies, or at the sea bottom. ESA

**N88-14309*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**ON THE SUBGRID-SCALE MODELING OF COMPRESSIBLE TURBULENCE Final Report**
C. G. Speziale, G. Erlebacher, T. A. Zang, and M. Y. Hussaini Dec. 1987 14 p Submitted for publication
(Contract NAS1-18107)
(NASA-CR-178420; ICASE-87-73; NAS 1.26:178420) Avail: NTIS HC A03/MF A01 CSCL 20D

A subgrid-scale model recently derived for use in the large-eddy simulation of compressible turbulent flows is examined from a fundamental theoretical and computational standpoint. It is demonstrated that this model, which is applicable only to compressible turbulent flows in the limit of small density fluctuations, correlates somewhat poorly with the results of direct numerical simulations of compressible isotropic turbulence at low Mach numbers. An alternative model, based on Favre-filtered fields, is suggested which appears to reduce these limitations. Author

**N88-14310#** Indiana Univ.-Purdue Univ., Indianapolis. School of Engineering and Technology.
**A ZONAL APPROACH FOR THE SOLUTION OF COUPLED EULER AND POTENTIAL SOLUTIONS OF FLOWS WITH COMPLEX GEOMETRIES Final Report, 1 Jun. 1983 - 31 May 1987**
Akin Ecer Jun. 1987 156 p
(Contract F49620-83-K-0034)
(AD-A185465; ET-S87-2; AFOSR-87-1350TR) Avail: NTIS HC A08/MF A01 CSCL 20D

A block-structured solution scheme was developed for the solution of three-dimensional Euler equations around complex geometric configurations. The overall effort included the development of a block-structured solution of both potential and Euler equations. The flow field around a complex geometry is divided into blocks with simple geometries. The computational grid is generated individually for each of the blocks and coupled automatically. For each of the blocks, either potential of Euler equations are solved independently using the finite element method. The normal mass and entropy fluxes are balanced between the blocks iteratively by using a relaxation scheme. This scheme is implemented on large computers (Cray and IBM) using parallel precessing capabilities. Author (GRA)

**N88-14311#** Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
**THREE-DIMENSIONAL STRUCTURE OF BOUNDARY LAYERS IN TRANSITION TO TURBULENCE Final Report, 1 Feb. 1984 - 28 Feb. 1987**
Thorwald Herbert 24 Jun. 1987 78 p
(Contract F49620-84-K-0002)
(AD-A185466; AFOSR-87-0981TR) Avail: NTIS HC A05/MF A01 CSCL 20D

A unified theory of secondary instability in wall-bound shear flows has been developed. This theory rests on Floquet systems of stability equations and permits classification and quantitative analysis of different modes of secondary instability in the three-dimensional stage of laminar-turbulent transition. The catalogue of solutions is consistent with observations and predicts other phenomena that have not been identified in experiments. The theoretical results have been used to reproduce patterns in flow visualizations by computer animation. Analysis of the energy balance has shown a feedback loop between mean flow, two-dimensional, and three-dimensional disturbances that is considered key to the process of self-sustained transiton. Various techniques have been developed to investigate details of the nonlinear three-dimensional processes involved in this feedback loop. GRA

**N88-14312#** Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.
**METHODS FOR REDUCING COMPUTATIONAL COSTS OF TYPICAL FINITE ELEMENT UNSTEADY HYDRODYNAMIC MODELS Final Report, Feb. 1986 - Sep. 1987**
A. J. Baker, P. D. Manhardt, and B. H. Johnson Sep. 1987 67 p
(AD-A185499; WES/MP/HL-87-5) Avail: NTIS HC A04/MF A01 CSCL 12A

Ideas suggested to reduce computational costs of typical finite element hydrodynamic codes are presented for implementation. Short-term suggestions include employing iterative solution solvers with perhaps a multigrid algorithm, uncoupling the governing equations and using linear interpolation for velocity to reduce the size of the coefficient matrix, and using explicit time integration with a condensed coefficient matrix. A top-down algorithm/code design from theory through to parallel processing is presented as a long-term solution. A tensor-product solution on at least a semi-regular block structured grid is proposed. With the finite element algorithm derived from the Taylor weak statement, stabilizing mechanisms are embedded such that selective dampening of the spurious short wavelength error modes is realized without a degradition of solution accuracy. Three-dimensional finite element hydrodynamic models based upon these concepts will

result in cost-effective solutions that possess good stability properties yet yield accurate solutions in high gradient regions.
GRA

**N88-14313#** Michigan State Univ., East Lansing. Turbulence Structure Lab.
**THE PRODUCTION OF TURBULENCE IN BOUNDARY LAYERS: THE ROLE OF MICROSCALE COHERENT MOTIONS Final Report, 1 Oct. 1984 - 30 Sep. 1986**
R. E. Falco Jun. 1987 105 p
(Contract F49620-85-C-0002)
(AD-A185568; TSL-87-3; AFOSR-87-1194TR) Avail: NTIS HC A06/MF A01 CSCL 20D

Details of the turbulence production process in turbulant boundary layers in the wall region have been clarified, especially the formation of the long streaky structure, and secondary hairpin vorticity. The outer region microscale coherent motion called a typical eddy plays the dominant role in the process. Long time averaged statistics of the two point vorticity-vorticity correlations support the conditionally sampled data and interpretations. The typical eddy produces the long streaks along with the pockets, and one of the hairpins directly. Several other hairpins form from the evolution of the vorticity produced by the passage of the typical eddy over the wall. A model of the typical eddy/wall region interaction, i.e., a vortex ring/Stokes layer interaction, was investigated to see if it could reproduce all of the turbulant boundary layer features associated with production, including the long streaks. By using the model, we have gained new insights into the sensitivity of the production process. Relatively small differences in the convection velocity of the excitation eddies have been found to result in the difference between turbulent boundary layer production and spot production. GRA

**N88-14314#** Naval Research Lab., Washington, D.C.
**CALCULATIONS OF THE TURBULENT WAKE BEHIND A SLENDER SELF-PROPELLED DOUBLE-BODY AND COMPARISONS WITH EXPERIMENT Interim Report, 1 Jan. 1987 - 6 Oct. 1987**
Thomas F. Swean, Jr. 6 Oct. 1987 44 p
(AD-A185661; NRL-MR-6075) Avail: NTIS HC A03/MF A01 CSCL 20D

The parabolic, incompressible, time-averaged Navier-Stokes equations together with a two-equation (kappa-epsilon) model of turbulence are used to numerically simulate the wake downstream of a slender double-body. The equations are solved using the finite-element method and the results are compared to experimental data for both unpropelled and self-propelled configurations. With the exception of certain localized phenomena, the calculations and experiments are found to be in good agreement for the mean velocity components, the turbulence kinetic energy, and the Reynolds shear stresses. The noteworthy exception for the unpropelled configuration is the prediction of a rather strong region of production of turbulence in the near wake which is not evident in the data. The simulation of the self-propelled wake is in good agreement with the data for the mean velocity components. There is also acceptable agreement for the turbulence parameters over most of the wake cross-section except near the radius of the propeller tips. Severe qualitative and quantitative discrepancies in this region are possible due to the presence of periodic components in the data. GRA

**N88-14315#** California Univ., Los Angeles. Dept. of Aerospace Engineering.
**STUDIES OF UNSTEADINESS IN BOUNDARY LAYERS Annual Report, 1 May 1986 - 30 Apr. 1987**
Ron Blackwelder, R. E. Kaplan, Chih-Ming Ho, Patrick Huerre, and Larry G. Redekopp 26 Jun. 1987 11 p
(Contract F49620-85-C-0080)
(AD-A185662; AFOSR-87-1405TR) Avail: NTIS HC A02/MF A01 CSCL 20D

Experimental and theoretical efforts aimed at clarifying and revealing important dynamical features of several turbulent shear flows are described. The flows studied include boundary layers, jets, wakes and separated flows on lifting surfaces. Significant progress has been made through experimental studies toward understanding: (1) processes in turbulent boundary layers responsible for the production of turbulent energy via local, inflectional-instability events and the modification of boundary layer growth and entrainment by passive large-eddy manipulation devices; (2) procedures for enhancing entrainment and mixing in jets either by actively forcing the flow or by passively contouring the jet exit; and (3) characteristics of boundary layer separation and its control on lifting surfaces in unsteady flows. Theoretical studies on the temporal and spatial structure in blunt-body wakes have revealed the necessary conditions under which global, self-sustained oscillations appear and, have provided firm criteria for specifying the frequency of these oscillations. The results are consistent with existing experimental evidence and suggest promising approaches for drag modifications for flow over bluff bodies. consistent with existing experimental evidence and suggest promising approaches for drag modifications for flow over bluff bodies. Several experimental facilities have been designed. Keywords: Separated flows; Unsteady flows; Turbulent shear flows. GRA

**N88-14316#** Ben Gurion Univ. of the Negev, Beersheva (Israel).
**ANALYTICAL INVESTIGATION OF REFLECTION OF A REGULAR OR MACH REFLECTION OVER A SECONDARY WEDGE Final Report, 1 Nov. 1986 - 30 Oct. 1987**
G. Ben-Dor, J. M. Dewey, and O. Igra 30 Oct. 1987 69 p
(Contract DAJA45-86-C-0038; DA Proj. 1L1-61102-BH-57)
(AD-A185690; R/D-5218-PH-01) Avail: NTIS HC A04/MF A01 CSCL 20D

This report analyses shock wave configurations which will occur when plane shock is incident on a double wedge for which the second wedge may have a greater (concave case) or smaller inclination (convex case) than the first wedge. It is shown that 7 different reflection processes may be expected depending on the Mach number of the incident shock M sub i and the two wedge angles theta sub w1 and theta sub w2. These processes may be defined by seven regions in the theta sub w1 and theta sub w2, plane, for a given value of m sub i. Each process was verified by sequences of shadowgraph and schlieren photographs. A shock polar analysis of each of the 7 processes provided information about the pressure changes and the wave structures which develop immediately behind the main reflections along the wedge surfaces. These wave structures were verified experimentally, and two types were observed: one normal to the reflecting surface, and the other in the form of a regular reflection. The criteria to determine which of these configurations will occur have not yet been established. It is believed that the present study will be of value in predicting the loading of shock waves on structures, and may lead to a better understanding of shock reflections from concave and convex cylindrical surfaces. GRA

**N88-14317#** Massachusetts Inst. of Tech., Cambridge. Computational Fluid Dynamics Lab.
**COMPUTATIONAL METHODS FOR COMPLEX FLOWFIELDS Final Technical Report, 1 Jun. 1982 - 31 May 1987**
Earll M. Murman and Judson R. Baron 31 Jul. 1987 168 p
(Contracts AF-AFOSR-82-0136; AF Proj. 2307)
(AD-A185793; AFOSR-87-1285TR) Avail: NTIS HC A08/MF A01 CSCL 20D

The development of solution algorithms for complex flowfields have been the objective of this research. Embedded subdomains were used to resolve relevant physical processes in a global flow around aerodynamic bodies. Both non-adaptive and adaptive approaches were studied and developed. Results for solving the two dimensional Euler equations using non-adaptive and adaptive finite volume and finite element work are summarized. A new approach is reported for combining expert system concepts with adaptive procedural algorithms into a totally integrated methodology. Algorithms for adaptive explicit and non-adaptive semi-implicit Navier-Stokes calculations are reported. Recent results on formulation of outflow boundary conditions for the Navier-Stokes equations are also presented. GRA

**N88-14318#** Pennsylvania State Univ., State College. Applied Research Lab.
**GAS DIFFUSION STUDIES IN STEADY AND NONSTEADY CAVITIES Ph.D. Thesis**
K. Ravindra and B. R. Parkin Sep. 1987 162 p
(AD-A185795; ARL/PSU/TR-87-003) Avail: NTIS HC A08/MF A01 CSCL 20D

A study is presented of gaseous diffusion into and turbulent entrainment from steady as well as nonsteady fully cavitating flows. The nonsteady cavity is characterized as a dynamic element in a water tunnel test section. An approximate theoretical analysis is done for gaseous diffusion across steady axisymmetric cavities. A comparison with experimental results reveals that the present approximate analysis is suited for better estimates of gaseous diffusion across the gas-liquid interface of axisymmetric cavities than past analyses. Water tunnel experiments for two dimensional flows were conducted on cavities behind a stationary and oscillating flat plate (wedge) hydrofoil. Steady cavity pressures were significantly higher than the vapor pressure of water and larger cavities tend to maintain higher cavity pressures. Unsteady cavity pressures were found to be significant only at low frequencies of profile oscillation. Downstream and upstream of the cavity, the oscillating cavity was observed to behave like dipole source at low frequencies of foil oscillation. An analysis of the oscillating cavity lengths revealed that for sinusoidal motions of the foil, the first two harmonics of the cavity motions are significant. GRA

**N88-14319#** Materials Research Labs., Ascot Vale (Australia).
**THE EFFECT OF COLLISION ANGLE ON MACH REFLECTION**
J. A. Waschl May 1987 19 p
(AD-A185798; MRL-R-1067) Avail: NTIS HC A03/MF A01 CSCL 20D

Following the successful application of the HULL code to the modelling of shock waves colliding with a smooth planar surface, as described in a previous report, the influence of collision angle on reflection type was investigated. The numerical investigations revealed examples of both regular and Mach reflection. From these an estimate of the transition collision angle for a non-decaying air shock wave of M sub I = 1.472 (overpressure of 137.9 kPa) was made. This angle was found to be approximately 41.5 deg. GRA

**N88-14320*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**HOST TURBINE HEAT TRANSFER PROGRAM SUMMARY**
Herbert J. Gladden and Robert J. Simoneau [1988] 22 p Prepared for presentation at the 33rd International Gas Turbine and Aeroengine Congress and Exposition, Amsterdam, The Netherlands, 5-9 Jun. 1988; sponsored in part by the American Society of Mechanical Engineers
(NASA-TM-100280; E-3876; NAS 1.15:100280) Avail: NTIS HC A03/MF A01 CSCL 20D

The objectives of the HOST Turbine Heat Transfer subproject were to obtain a better understanding of the physics of the aerothermodynamic phenomena and to assess and improve the analytical methods used to predict the flow and heat transfer in high temperature gas turbines. At the time the HOST project was initiated, an across-the-board improvement in turbine design technology was needed. A building-block approach was utilized and the research ranged from the study of fundamental phenomena and modeling to experiments in simulated real engine environments. Experimental research accounted for approximately 75 percent of the funding with the remainder going to analytical efforts. A healthy government/industry/university partnership, with industry providing almost half of the research, was created to advance the turbine heat transfer design technology base. Author

**N88-14321*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**MEASUREMENTS OF THE FREE STREAM FLUCTUATIONS ABOVE A TURBULENT BOUNDARY LAYER**
David H. Wood and Russell V. Westphal Nov. 1987 31 p
(NASA-TM-100036; A-88011; NAS 1.15:100036) Avail: NTIS HC A03/MF A01 CSCL 20D

This paper investigates the velocity fluctuations in the free stream above an incompressible turbulent boundary layer developing at constant pressure. It is assumed that the fluctuations receive contributions from three statistically independent sources: (1) one-dimensional unsteadiness, (2) free stream turbulence, and (3) the potential motion induced by the turbulent boundary layer. Measurements were made in a wind tunnel with a root-mean-square level of the axial velocity fluctuations of about 0.2 percent. All three velocity components were measured using an X-wire probe. The unsteadiness was determined from the spanwise covariance of the axial velocity, measured using two single wire probes. The results show that it is possible to separate the contributions to the r.m.s. level of the velocity fluctuations, without resorting to the dubious technique of high-pass filtering. The separation could be extended to the spectral densities of the contributions, if measurements of sufficient accuracy were available. The Appendix provides a general guide for the measurement of small free stream fluctuation levels. Author

**N88-14322*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**EULER SOLUTION OF MULTIBLADE ROTOR FLOW**
C. L. Chen, W. J. McCroskey, and S. X. Ying (Sterling Software, Palo Alto, Calif.) Jan. 1988 18 p Presented at the 13th European Rotorcraft Forum, Arles, France, 8-11 Sep. 1987
(NASA-TM-100014; A-87307; NAS 1.15:100014; USAAVSCOM-TR-87-A-15) Avail: NTIS HC A03/MF A01 CSCL 20D

A numerical method for solving the Euler equations for multiblade rotors has been developed and some preliminary results reported. The numerical scheme is a combination of several recent methods and algorithm improvements, adapted to the particular requirements of rotor-body interactions. A cylindrical basic grid has been used to study conventional multiblade helicopter rotors. Test calculations have been made for two- and six-blade rotors in hover and for a two-blade rotor in forward flight, under transonic tip conditions but without lift. The results show good agreement with experimental data. Author

**N88-14323*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**CHARACTERISTICS OF A SEPARATING CONFLUENT BOUNDARY LAYER AND THE DOWNSTREAM WAKE**
Desmond Adair and W. Clifton Horne Dec. 1987 91 p
(NASA-TM-100046; A-88034; NAS 1.15:100046) Avail: NTIS HC A05/MF A01 CSCL 20D

Measurements of pressure and velocity characteristics are presented and analyzed for flow over and downstream of a NACA 4412 airfoil equipped with a NACA 4415 single-slotted flap at high angle of attack and close to maximum lift. The flow remained attached over the main element while a large region of recirculating flow occurred over the aft 61 percent of the flap. The airfoil configuration was tested at a Mach number of 0.09 and a chord Reynolds number of 1.8x10 to the 6th power in the NASA Ames Research Center 7- by 10-Foot Wind Tunnel. Measurement of mean and fluctuation velocities were obtained in regions of recirculation and high turbulence intensity using 3-D laser velocimetry. In regions where the flow had a preferred direction and relatively low turbulence intensity, hot-wire anemometry was used. Emphasis was placed on obtaining characteristics in the confluent boundary layer, the region of recirculating flow, and in the downstream wake. Surface pressure measurements were made on the main airfoil, flap, wind tunnel roof and floor. It is thought likely that because the model is large when compared to the wind tunnel cross section, the wind tunnel floor and ceiling interference should be taken into account when the flow field is calculated. Author

**N88-14136#** Joint Publications Research Service, Arlington, Va.
**VISIBLE BOUNDARY LAYER TRANSITION POINTS THROUGH FLIGHT TESTS Abstract Only**
Takeru Onuki *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 61-62 Transl. into ENGLISH from

Kogiken Nyusu (Tokyo, Japan), May 1987 p 7-8 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

**N88-14137#** Joint Publications Research Service, Arlington, Va.
**NUMERICAL SIMULATION OF FLIGHT BODY CIRCUMFERENCE FLOW Abstract Only**
*In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 62-64 Transl. into ENGLISH from Kogiken Nyusu (Tokyo, Japan), May 1987 p 8-10 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

**N88-14138#** Joint Publications Research Service, Arlington, Va.
**RESEARCH ON INTERNAL FLUID MECHANISM BETWEEN TURBINE BLADES Abstract Only**
Takamasa Yamamoto *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 64-65 Transl. into ENGLISH from Kogiken Nyusu (Tokyo, Japan), May 1987 p 10-11 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

**N88-14372#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
**NUMERICAL SIMULATION OF FLOWS IN AXIAL AND RADIAL TURBOMACHINES USING EULER SOLVERS**
Georges Meauze and Antoine Fourmaux *In* Von Karman Inst. for Fluid Dynamics, Small High Pressure Ratio Turbines 1987 56 p (For primary document see N88-14364 06-37)
Avail: NTIS HC A17/MF A01

**N88-14733#** Joint Publications Research Service, Arlington, Va.
**ROTATION OF MAGNETIZED PARTICLE IN ELECTRICALLY CONDUCTING VISCOUS MEDIUM Abstract Only**
B. M. Berkovskiy, B. E. Kashevskiy, and Yu. V. Poroshin *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 9 Transl. into ENGLISH from Magnitnaya Gidrodinamika (Riga, USSR), no. 4, Oct. - Dec. 1986 p 37-42 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14734#** Joint Publications Research Service, Arlington, Va.
**NEW EQUILIBRIUM FORMS OF FREE SURFACE OF CONFINED MAGNETIC FLUID Abstract Only**
V. M. Berkovskiy, V. G. Bashtovoy, and A. G. Reks *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 10 Transl. into ENGLISH from Magnitnaya Gidrodinamika (Riga, USSR), no. 4, Oct. - Dec. 1986 p 11-16 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14735#** Joint Publications Research Service, Arlington, Va.
**METHOD OF TWO-TIME GREEN FUNCTIONS IN MOLECULAR HYDRODYNAMICS OF SUPERFLUID LIQUID Abstract Only**
Yu. A. Tserkovnikov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 11 Transl. into ENGLISH from Teoreticheskaya i Matematicheskaya Fizika (Moscow, USSR), v. 69, no. 3, Dec. 1986 p 439-465 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14736#** Joint Publications Research Service, Arlington, Va.
**FAR FIELD OF STEADY WAVES PRODUCED BY LOCAL PERTURBATION SOURCES IN STREAM OF STRATIFIED FLUID Abstract Only**
V. F. Sannikov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 11 Transl. into ENGLISH from Prikladnaya Matematika i Mekhanika (Moscow, USSR), v. 50, no. 6, Nov. - Dec. 1986 p 987-995 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14737#** Joint Publications Research Service, Arlington, Va.
**METHOD OF CALCULATIONS FOR FLOW OF IDEAL GAS THROUGH PLANE AND AXISYMMETRIC NOZZLES WITH BROKEN-LINE CONTOUR Abstract Only**
A. N. Krayko, N. I. Tillyayeva, and S. A. Shcherbakov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 12 Transl. into ENGLISH from Zhurnal Vychislitelnoy Matematiki i Matematicheskoy Fiziki (Moscow, USSR), v. 26, no. 11, Nov. 1986 p 1679-1694 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

# 35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

**N88-14324#** Los Alamos National Lab., N. Mex.
**COMPUTER SIMULATION OF THE L/SUB 3/-EDGE DENSITOMETER**
D. Langner Nov. 1987 28 p
(Contract W-7405-eng-36)
(DE88-001944; LA-11073-MS) Avail: NTIS HC A03/MF A01

Since the L(sub 3)-edge densitometer was first fielded in 1977, it has displayed a 1 to 1.5 percent nonlinear deviation from its theoretical linear calibration response. In an effort to explain this nonlinear deviation, this study used a simple, closed-form computer simulation to examine the effects of several variables on the densitometer's measurement of uranium and plutonium in solution. The results of this simulation suggest that the variables contribution to this nonlinearity include the effects of small-angle scattering and the detection system resolution function. The simulation also examined the effects of matrix contaminants, the shape of the incoming beam, the uranium-to-plutonium ratio for mixed solutions, and the data-reduction technique. All of these variables were found to have some effect on the assay results, although these were generally small. The calculations demonstrate that using a new edge-extrapolation data-reduction technique reduces the instrument's sensitivity to many of these variables. DOE

**N88-14325*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**AIRBORNE VISIBLE/INFRARED IMAGING SPECTROMETER (AVIRIS). A DESCRIPTION OF THE SENSOR, GROUND DATA PROCESSING FACILITY, LABORATORY CALIBRATION, AND FIRST RESULTS**
Gregg Vane, ed. 15 Nov. 1987 102 p Presented at the Imaging Spectroscopy 2 Conference of the 31st Annual International Symposium on Optical and Optoelectronic Applied Science and Engineering, San Diego, Calif., 20-21 Aug. 1987
(Contract NAS7-918)
(NASA-CR-182365; JPL-Pub-87-38; NAS 1.26:182365) Avail: NTIS HC A06/MF A01 CSCL 14B

The papers in this document were presented at the Imaging Spectroscopy 2 Conference of the 31st International Symposium on Optical and Optoelectronic Applied Science and Engineering, in San Diego, California, on 20 and 21 August 1987. They describe the design and performance of the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) sensor and its subsystems, the ground data processing facility, laboratory calibration, and first results. For individual titles, see N88-14326 through N88-14335.

**N88-14326*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**A SYSTEM OVERVIEW OF THE AIRBORNE VISIBLE/INFRARED IMAGING SPECTROMETER (AVIRIS)**
Wallace M. Porter and Harry T. Enmark *In its* Airborne

Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results 15 Nov. 1987 p 3-12 (For primary document see N88-14325 06-35)
Avail: NTIS HC A06/MF A01 CSCL 14B

The AVIRIS instrument has been designed to do high spectral resolution remote sensing of the Earth. Utilizing both silicon and indium antimonide line array detectors, AVIRIS covers the spectral region from 0.41 to 2.45 microns in 10-nm bands. It was designed to fly aboard NASA's U-2 and ER-2 aircraft, where it will simulate the performance of future spacecraft instrumentation. Flying at an altitude of 20 km, it has an instantaneous field of view of 20 m and views a swath over 10 km wide. With an ability to record 40 minutes of data, it can, during a single flight, capture 500 km of flight line. Author

**N88-14327*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**AIRBORNE VISIBLE/INFRARED IMAGING SPECTROMETER (AVIRIS) SPECTROMETER DESIGN AND PERFORMANCE**
Steven A. Macenka and Michael P. Chrisp *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results 15 Nov. 1987 p 13-24 (For primary document see N88-14325 06-35)
Avail: NTIS HC A06/MF A01 CSCL 14B

The development of the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) has been completed at JPL. This paper outlines the functional requirements of the spectrometer optics subsystem, and describes the spectrometer optical design. The optical subsystem performance is shown in terms of spectral modulation transfer functions, radial energy distributions, and system transmission at selected wavelengths for the four spectrometers. An outline of the spectrometer alignment is included. Author

**N88-14328*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**AVIRIS FOREOPTICS, FIBER OPTICS AND ON-BOARD CALIBRATOR** **c74**
Michael P. Chrisp, Thomas G. Chrien, and L. Steimle *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results 15 Nov. 1987 p 25-30 (For primary document see N88-14325 06-35)
Avail: NTIS HC A06/MF A01 CSCL 14B

The foreoptics, fiber optic system and calibration source of the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) are described. The foreoptics, based on a modified Kennedy scanner, is coupled by optical fibers to the four spectrometers. The optical fibers allow convenient positioning of the spectrometers in the limited space and enable simple compensation of the scanner's thermal defocus (at the -23 C operating temp) by active control of the fiber focal plane position. A challenging requirement for the fiber optic system was the transmission to the spectral range 1.85 to 2.45 microns at .45 numerical aperture. This was solved with custom fluoride glass fibers from Verre Fluore. The onboard calibration source is also coupled to the spectrometers by the fibers and provides two radiometric levels and a reference spectrum to check the spectrometers' alignment. Results of the performance of the assembled subsystems are presented. Author

**N88-14329*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**VISIBLE AND INFRARED LINEAR DETECTOR ARRAYS FOR THE AIRBORNE VISIBLE/INFRARED IMAGING SPECTROMETER (AVIRIS)**
Gary C. Bailey *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results 15 Nov. 1987 p 31-35 (For primary document see N88-14325 06-35)
Avail: NTIS HC A06/MF A01 CSCL 14B

The Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) instrument uses four separate focal plane assemblies consisting of line array detectors that are multiplexed to a common J-FET preamp using a FET switch multiplexing (MUX) technique. A 32-element silicon line array covers the spectral range from 0.41 to 0.70 microns. Three additional 64-element indium antimonide (InSb) line arrays cover the spectral range from 0.68 to 2.45 microns. The spectral sampling interval per detector element is nominally 9.8 nm, giving a total of 224 spectral channels. All focal planes operate at liquid nitrogen temperature and are housed in separate dewars. Electrical performance characteristics include a read noise of less than 1000 e(-) in all channels, response and dark nonuniformity of 5 percent peak to peak, and quantum efficiency of greater than 60 percent. Author

**N88-14330*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**AVIRIS SCAN DRIVE DESIGN AND PERFORMANCE**
D. C. Miller *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results 15 Nov. 1987 p 37-44 (For primary document see N88-14325 06-35)
Avail: NTIS HC A06/MF A01 CSCL 14B

The Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) images the ground with an instantaneous field of view (IFOV) of 1 mrad. The IFOV is scanned 30 deg from left to right to provide the cross-track dimension of the image, while the aircraft's motion provides the along-track dimension. The scanning frequency is 12 Hz, with a scan efficiency of 70 percent. The scan mirror has an effective diameter of 5.7 in, and its positional accuracy is a small fraction of a milliradian of the nominal position-time profile. Described are the design and performance of the scan drive mechanism. Tradeoffs among various approaches are discussed, and the reasons given for the selection of the cam drive. Author

**N88-14331*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**SIGNAL CHAIN FOR THE AIRBORNE VISIBLE/INFRARED IMAGING SPECTROMETER (AVIRIS)**
James S. Bunn, Jr. *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results 15 Nov. 1987 p 45-50 (For primary document see N88-14325 06-35)
Avail: NTIS HC A06/MF A01 CSCL 14B

The AVIRIS instrument has a separate dedicated analog signal processing chain for each of its four spectrometers. The signal chains amplify low-level focal-plane line array signals (5 to 10 mV full-scale span) in the presence of larger multiplexing signals (approx 150 mV) providing the data handling system a ten-bit digital word (for each spectrometer) each 1.3 microns. This signal chain provides automatic correction for the line array dark signal nonuniformity (which can approach the full-scale signal span). Author

**N88-14332*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**AVIRIS ONBOARD DATA HANDLING AND CONTROL**
Ronald E. Steinkraus and Roger W. Hickok *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results 15 Nov. 1987 p 51-60 (For primary document see N88-14325 06-35)
Avail: NTIS HC A06/MF A01 CSCL 14B

The timing and flow of detector and ancillary data for the Airborne Visible/Infrared imaging spectrometer (AVIRIS) are controlled within the instrument by its digital electronics assembly. In addition to providing detector and signal chain timing, the digital electronics receives, formats, and rate-buffers digitized science data; collects and formats ancillary (calibration and engineering) data; and merges both into a single tape record. Overall AVIRIS data handling is effected by a combination of dedicated digital electronics to control instrument timing, image data flow, and data

rate buffering and a microcomputer programmed to handle real-time control of instrument mechanisms and the coordinated preparation of ancillary data. Author

**N88-14333*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**AVIRIS GROUND DATA-PROCESSING SYSTEM**
John H. Reimer, Jan R. Heyada, Steve C. Carpenter, William T. S. Deich, and Meemong Lee *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results 15 Nov. 1987 p 61-72 (For primary document see N88-14325 06-35)
Avail: NTIS HC A06/MF A01 CSCL 14B

The Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) has been under development at JPL for the past four years. During this time, a dedicated ground data-processing system has been designed and implemented to store and process the large amounts of data expected. This paper reviews the objectives of this ground data-processing system and describes the hardware. An outline of the data flow through the system is given, and the software and incorporated algorithms developed specifically for the systematic processing of AVIRIS data are described. Author

**N88-14334*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**SPECTRAL AND RADIOMETRIC CALIBRATION OF THE AIRBORNE VISIBLE/INFRARED IMAGING SPECTROMETER**
Gregg Vane, Thomas G. Chrien, Edward A. Miller, and John H. Reimer *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results 15 Nov. 1987 p 73-87 (For primary document see N88-14325 06-35)
Avail: NTIS HC A06/MF A01 CSCL 14B

The laboratory spectral and radiometric calibration of the AVIRIS science data collected since 1987 is described. The instrumentation and procedures used in the calibration are discussed and the accuracy achieved in the laboratory as determined by measurement and calculation is compared with the requirements. Instrument performance factors affecting radiometry are described. The paper concludes with a discussion of future plans. Author

**N88-14335*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**FIRST RESULTS FROM THE AIRBORNE VISIBLE/INFRARED IMAGING SPECTROMETER (AVIRIS)**
Gregg Vane *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results 15 Nov. 1987 p 89-97 (For primary document see N88-14325 06-35)
Avail: NTIS HC A06/MF A01 CSCL 14B

After engineering flights aboard the NASA U-2 research aircraft in the winter of 1986 to 1987 and spring of 1987, extensive data collection across the United States was begun with the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) in the summer of 1987 in support of a NASA data evaluation and technology assessment program. This paper presents some of the first results obtained from AVIRIS. Examples of spectral imagery acquired over Mountain View and Mono Lake, California, and the Cuprite Mining District in western Nevada are presented. Sensor performance and data quality are described, and in the final section of this paper, plans for the future are discussed. Author

**N88-14336#** Rome Univ. (Italy). Dipartimento di Fisica.
**ASTROMAG: A PARTICLE SPECTROMETER FOR THE SPACE STATION**
G. Auriemma 30 Apr. 1987 16 p Presented at the 3rd Pisa Meeting on Advanced Detectors, Castiglione dalla Pescaia, Italy, 2-7 Jun. 1986
(Preprint-557; ETN-88-91270) Avail: NTIS HC A03/MF A01

The use of a large superconducting magnet (Astromag) on the Columbus Space Station to study charged particles of nonsolar origin is discussed. Astromag can be used to measure the spectra of antiprotons and positons; search for antihelium; determine chemical composition in the TeV range; and measure the isotopic composition of cosmic ray nuclei. A configuration using one end of the magnet for a matter antimatter spectrometer and the other for a cosmic ray isotope spectrometer is proposed. ESA

**N88-14337*#** Stanford Univ., Calif. Center for Space Science and Astrophysics.
**THE EVALUATION OF A DEFORMABLE DIFFRACTION GRATING FOR A STIGMATIC EUV SPECTROHELIOMETER Progress Report, 1 Jun. - 30 Nov. 1987**
J. G. Timothy Nov. 1987 38 p
(Grant NAGw-540)
(NASA-CR-182371; NAS 1.26:182371) Avail: NTIS HC A03/MF A01 CSCL 14B

A high-efficiency, extreme ultraviolet (EUV) imaging spectrometer is constructed and tested. The spectrometer employs a concave toroidal grating illuminated at normal incidence in a Rowland circle mounting and has only one reflecting surface. The toroidal grating has been fabricated by a new technique employing an elastically-deformable sub-master grating replicated in a spherical form and then mechanically distorted to produce the desired aspect ratio of the toroidal surface for stigmatic imaging over the selected wavelength range. The fixed toroidal grating used in the spectrometer is then replicated from this surface. Photographic tests and initial photoelectric tests with a two-dimensional, pulse-counting detector system verify the image quality of the toroidal grating at wavelengths near 600 A. The results of these tests and the basic designs of two instruments which could employ the imaging spectrometer for astrophysical investigations in space are described; i.e., a high-resolution EUV spectroheliometer for studies of the solar chromosphere, transition region, and corona; and an EUV spectroscopic telescope for studies of non-solar objects. Author

**N88-14338#** Carnegie-Mellon Univ., Pittsburgh, Pa. Software Engineering Inst.
**TIMING VARIATION IN DUAL LOOP BENCHMARKS Final Report**
Neal Altman and Nelson Weiderman Oct. 1987 26 p
(Contract F19628-85-C-0003)
(AD-A185697; CMU/SEI-87-TR-21; ESD-TR-87-172) Avail: NTIS HC A03/MF A01 CSCL 14B

Benchmarks that measure time values using a standard system clock often employ a dual loop design. One of the important assumptions of this design is that textually identical loop statement will take the same amount of time to execute. This assumption was tested on two bare computers with Ada test programs and has been demonstrated to be inaccurate in these specific test cases. GRA

**N88-14339*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**RECENT ADVANCES IN HIGH TEMPERATURE INSTRUMENTATION FOR HOT SECTION APPLICATIONS**
David R. Englund and Richard G. Seasholtz [1988] 25 p Prepared for presentation at the 33rd International Gas Turbine and Aeroengine Congress and Exposition, Amsterdam, The Netherlands, 5-9 Jun. 1988; sponsored in part by the American Society of Mechanical Engineers
(NASA-TM-100282; E-3923; NAS 1.15:100282) Avail: NTIS HC A03/MF A01 CSCL 14B

Programs to develop research instrumentation for use in turbine engine hot sections are described. These programs were initiated to provide improved measurements capability as support for a multidisciplinary effort to establish technolgy leading to improved hot section durability. Specific measurement systems described here include heat flux sensors, a dynamic gas temperature measuring system, laser anemometry for hot section applications, an optical system for viewing the interior of a combustor during operation, thin film sensors for surface temperature and strain measurements, and high temperature strain measuring systems. The paper describes the state of the development of these sensors

and measuring systems and, in some cases, will show examples of measurements made with this instrumentation.The paper covers work done at the NASA Lewis Research Center and at various contract and grant facilities. Author

**N88-14340#** National Oceanic and Atmospheric Administration, Washington, D. C. National Environmental Satellite, Data and Information Service.
**AVHRR/HIRS (ADVANCED VERY HIGH RESOLUTION RADIOMETER/HIGH RESOLUTION INFRA-RED SOUNDER) OPERATIONAL METHOD FOR SATELLITE BASED SEA SURFACE TEMPERATURE DETERMINATION**
C. Walton Mar. 1987 67 p
(PB88-107594; NOAA-TR-NESDIS-28) Avail: NTIS HC A04/MF A01 CSCL 14B

A technique is described which was used operationally to produce sea surface temperatures from the NOAA polar orbiting satellites between 1976 and 1981. The single window channel technique used before 1976 is described in NOAA Technical Memorandum NESS 78 while the multiple window channel technique (MCSST) applied since 1981 is well documented in the scientific literature. The report bridges the gap between these two periods and provides a continuous record of the evolution of one of NOAA's primary satellite derived meteorological products. GRA

**N88-14193#** Joint Publications Research Service, Arlington, Va.
**RECORDING MATERIALS FOR OPTICAL DISK MEMORY DISCUSSED**
Tsutomu Ueno *In its* JPRS Report: Science and Technology. Japan 16 Jul. 1987 p 9-24 Transl. into ENGLISH from Ceramics Japan (Tokyo), Dec. 1986 p 1077-1083 (For primary document see N88-14191 06-27)
Avail: NTIS HC A06/MF A01

**N88-14745#** Joint Publications Research Service, Arlington, Va.
**SELECTION OF HOLOGRAPHIC SCREEN FOR PROJECTION OF IMAGES RECONSTRUCTED BY MULTIASPECT HOLOGRAMS OF FOCUSED IMAGES Abstract Only**
A. D. Galpern and A. A. Paramonov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 34 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 61, no. 6, Dec. 1986 p 1320-1325 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

## 36 LASERS AND MASERS

Includes parametric amplifiers.
For related information see also *76 Solid-State Physics.*

**N88-14341#** Institut Franco-Allemand de Recherches, St. Louis (France).
**OPTIMIZATION OF FIELD EMISSION ELECTRON BEAM SOURCES FOR HIGH-POWER LASERS**
M. Hugenschmidt and J. Wey 30 Jun. 1986 53 p In GERMAN and FRENCH Sponsored by Direction des Recherches, Etudes et Techniques, Paris, France
(PB87-218814; ISL-R-117/86) Avail: NTIS HC E04/MF E04 CSCL 20E

In the study, researchers constructed and investigated large-surface field emission beam sources. The electron current densities obtained were examined with a Faraday-Becher probe which captures the current pulses furnished by the Marx generator at the same time magneto-optically in each case. It was demonstrated that stable discharge progress with acceleration voltages of up to 400 kV is possible with the selected construction in direct approach of the electron beam sources with the Marx generator without interposition of a pulse-forming transfer line. Electron current densities of up to several A/sq cm were achieved for different cathode configurations with typical pulse half widths of from 600 to 800 ns. GRA

**N88-14342#** Los Alamos National Lab., N. Mex.
**AN ANALYSIS OF THE EFFECT OF SYSTEM VARIABLES ON THE QUALITY OF THIN FILMS AND POWDERS PRODUCED BY LASER-BREAKDOWN CHEMICAL VAPOR DEPOSITION**
E. L. Joyce, Jr. and T. R. Jervis 1987 5 p Presented at the Nuclear Science Symposium, San Francisco, Calif., 21 Oct. 1987
(Contract W-7405-eng-36)
(DE88-001793; LA-UR-87-3574; CONF-871006-6) Avail: NTIS HC A02/MF A01

A gas phase process for large area depositions on an ambient temperature substrate using laser-induced dielectric breakdown of gas phase precursors has recently been developed. Deposits of nickel alloys show excellent grain refinement (less than 10 nm) and metastable phase incorporation due to rapid quenching from the gas phase. Particle size distribution and compositional variance within the deposited films have been studied using electron microscopy and electron diffraction. Kinetic expressions to explain homogeneous gas phase nucleation and growth of the deposited materials have been developed in an effort to better understand this process. The effect of system variables on film and powder grain sizes has been studied. This analysis gives insight into the fluid flow/heat transfer patterns involved in the system and their effect on the final deposited material. Heat transfer and fluid flow patterns must be optimized to minimize residence time in the gas phase to prevent excessive agglomeration of the fine particles. Results of the effect of system pressure, gas phase composition, laser pulse energy, and gas flow rate are presented as they affect deposition particle size distribution. DOE

**N88-14343*#** Illinois Univ., Urbana-Champaign. Electro-Optic Systems Lab.
**EVALUATION OF A SATELLITE LASER RANGING TECHNIQUE USING PSEUDONOISE CODE MODULATED LASER DIODES Technical Report, Dec. 1987**
Carolyn Kay Ball Dec. 1987 43 p
(Grant NsG-5049)
(NASA-CR-182347; NAS 1.26:182347; UILU-ENG-87-2553; EOSL-87-007) Avail: NTIS HC A03/MF A01 CSCL 20E

Several types of Satellite Laser Ranging systems exist, operating with pulsed, high-energy lasers. The distance between a ground point and an orbiting satellite can be determined to within a few centimeters. A new technique substitutes pseudonoise code modulated laser diodes, which are much more compact, reliable and less costly, for the lasers now used. Since laser diode technology is only now achieving sufficiently powerful lasers, the capabilities of the new technique are investigated. Also examined are the effects of using an avalanche photodiode detector instead of a photomultiplier tube. The influence of noise terms (including background radiation, detector dark and thermal noise and speckle) that limit the system range and performance is evaluated. Author

**N88-14344#** Joint Publications Research Service, Arlington, Va.
**USSR REPORT: PHYSICS AND MATHEMATICS**
29 Apr. 1987 65 p Transl. into ENGLISH from various Russian articles
(JPRS-UPM-87-006) Copyright Avail: NTIS HC A04/MF A01

Topics addressed in lasers include: phase distortion compensation; continuous wave CO2 lasers; active medium formation in lasers; effect of atmospheric clarification; and lasers with wavefront reversing mirrors. For individual titles, see N88-14345 through N88-14349.

**N88-14345#** Joint Publications Research Service, Arlington, Va.
**COMPENSATION OF SMALL-SCALE PHASE DISTORTIONS BY MEANS OF A FOURIER PHASE CORRECTOR**
S. I. Klimentyev, V. V. Kononov, V. I. Kuprenyuk, L. D. Smirnova, V. V. Sergeyev, and V. Ye. Sherstobitov *In its* USSR Report: Physics and Mathematics 29 Apr. 1987 p 1-5 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 12, Dec. 1985 p 2501-2504 (For primary document see N88-14344 06-36)
Copyright Avail: NTIS HC A04/MF A01

The possibility of effectively compensating for small-scale phase distortions of the wavefront of a CO2 laser by means of a WFR system based on a Zernike cell is experimentally demonstrated. The Strel number of a beam transmitted through the phase plate twice was increased by compensation from 0.43 to 0.86. The basic factors determining the quality of distortion compensation are discussed. Author

**N88-14346#** Joint Publications Research Service, Arlington, Va.
**REPETITIVELY PULSED AND CONTINUOUS WAVE CO2 LASERS PUMPED BY A PULSED SELF-SUSTAINED DISCHARGE FOR THERMAL PROCESSING**
S. V. Drobyazko, Yu. V. Pavlovich, and Yu. M. Senatorov *In its* USSR Report: Physics and Mathematics 29 Apr. 1987 p 6-11 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 12, Dec. 1985 p 2467-2470 (For primary document see N88-14344 06-36)
Copyright Avail: NTIS HC A04/MF A01

The design and characteristics of the radiation from fast-flow repetitively pulsed (power up to 3.5 kW) and continuous wave (up to 1.8 kW) CO2 lasers excited by a pulsed self-sustained discharge are described. A laser pulse duration of up to 5 msec is attained and continuous modulated radiation is achieved for the first time by exciting the active medium with short (1 to 3 msec) discharge pulses. Examples of using such a laser in thermal processing are presented. Author

**N88-14347#** Joint Publications Research Service, Arlington, Va.
**ACTIVE MEDIUM FORMATION IN LASERS USING MIXTURES OF INERT GASES AND OPTICAL BREAKDOWN PUMPING**
V. V. Apollonov, S. I. Derzhavin, A. M. Prokhorov, and A. A. Sirotkin *In its* USSR Report: Physics and Mathematics 29 Apr. 1987 p 12-16 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 12, Dec. 1985 p 2389-2391 Original language document was announced in IAA as A86-27501 (For primary document see N88-14344 06-36)
Copyright Avail: NTIS HC A04/MF A01

The physical parameters of the active medium in lasers using He-Xe and He-Ar gas mixtures were investigated experimentally. Excitation of the gas mixtures was carried out by means of optical breakdown pumping in the UV range using a CO2 laser. The wavelengths corresponding to optical breakdown in the He-Xe gas mixture were 2.03 and 2.65 microns, respectively; optical breakdown in the He-Ar laser coincided with a wavelength of 1.79 microns. It is shown that the combined effects of the UV radiation and the shock wave created by optical breakdown is the main mechanism of laser action in He-Xe and He-Ar active media. IAA

**N88-14348#** Joint Publications Research Service, Arlington, Va.
**EFFECT OF CLARIFYING THE ATMOSPHERE IN RELATION TO QUASI-MONOCHROMATIC CO2 LASER RADIATION**
N. F. Borisova, V. M. Osipov, and N. I. Pavlov *In its* USSR Report: Physics and Mathematics 29 Apr. 1987 p 17-21 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 12, Dec. 1985 p 2505-2507 Original language document was announced in IAA as A86-27519 (For primary document see N88-14344 06-36)
Copyright Avail: NTIS HC A04/MF A01

The relation between the finite width of a CO2 laser line and its transmission properties through the atmosphere is investigated. It is shown that an increase in the lasing line width to several hundredths per cm can lead to a twofold increase in the amount of laser beam transmitted through the atmosphere along a vertical path from the ground to the upper atmospheric boundary. The increase in atmospheric transmissin due to detuning of the lasing line from the resonant absorption lines may also be enhanced by taking the width of the lasing line into account. IAA

**N88-14349#** Joint Publications Research Service, Arlington, Va.
**LASERS WITH WAVEFRONT-REVERSING MIRRORS (REVIEW ARTICLE)**
I. M. Beldyugin, B. Ya. Zeldovich, M. V. Zolotarev, and V. V. Shkunov *In its* USSR Report: Physics and Mathematics 29 Apr. 1987 p 22-62 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 12, Dec. 1985 p 2394-2421 Original language document was announced in IAA as A86-27502 (For primary document see N88-14344 06-36)
Copyright Avail: NTIS HC A04/MF A01

The physical principles underlying the design of lasers with wavefront reversing (WFR) mirrors are discussed. Methods for determining the transverse and longitudinal mode structure of a WFR mirror-laser are described in detail. Some of the advantages and disadvantages of different WFR mirror designs are considered, with emphasis given to four-wave mixing WFR mirrors, Raman mirrors, retroreflectors, and adaptive mirrors. Schematic line drawings of the different WFR mirror laser configurations are provided. IAA

**N88-14350*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**DUAL MODE LASER VELOCIMETER Patent**
William D. Gunter, Jr., inventor (to NASA), Ralph W. Donaldson, inventor (to NASA), and Alma G. Anderson, Jr., inventor (to NASA) 6 Oct. 1987 8 p Filed 31 Mar. 1986 Supersedes N86-24978 (24 - 15, p 2461)
(NASA-Case-ARC-11634-1; US-Patent-4,697,922; US-Patent-Appl-SN-846427; US-Patent-Class-356-28.5; US-Patent-Class-350-163; US-Patent-Class-350-174; US-Patent-Class-350-572; US-Patent-Class-350-573) Avail: US Patent and Trademark Office CSCL 20E

Described is a laser Doppler velocimeter (LDV) which is capable of operating with a small focus diameter for analyzing fluid flows at low velocity with high spatial resolution, or with a larger focus diameter to measure fluid flows at higher velocities accurately. More particularly, this is an LDV in which a simple reversal of a lens pair will allow it to operate in the two focus diameter modes. Official Gazette of the U.S. Patent and Trademark Office

**N88-14351#** TRW Space Technology Labs., Redondo Beach, Calif.
**NITROGEN SCALE-UP Final Report, 9 Sep. 1984 - 2 Sep. 1985**
Jeanette A. Betts and Joseph M. Fukumoto Jun. 1987 66 p
(Contract F29601-84-C-0074)
(AD-A185702; AFWL-TR-86-03) Avail: NTIS HC A04/MF A01 CSCL 20E

Experiments are described which investigated the Continuous Wave (CW) scaling of excited nitrogen production in an H/NF2 reaction system. The purpose is to assess the potential for the development of an electronic transition chemical laser using N2(A) as an energy transfer donor. The experiments use a chemical laser combustor to produce fluorine atoms which are subsequently mixed with hydrogen to produce H-atoms. Heated tetrafluorohydrazine is subsequently mixed in the stream through a HYLYTE nozzle to initiate the H/NF2 chemistry. In a second series of experiments, NF3 was burned in the combustor to produce NF2 and F-atoms which were then mixed with H2 to initiate the desired chemistry. Relatively low yields of excited nitrogen were obtained in all experiments. The highest observed densities were of the order of 10 12N2(A) and N2(B). Parametric plots used to optimize the system are presented. GRA

**N88-14352#** Victoria Univ. of Manchester (England). Dept. of Chemistry.
**THE KINETICS AND DYNAMICS OF IODINE MONOFLUORIDE FORMATION IN GAS-PHASE COLLISIONS Interim Scientific Report, 1 Dec. 1985 - 30 Nov. 1986**
J. C. Whitehead 17 Jun. 1987 7 p
(Grant AF-AFOSR-0039-85)
(AD-A185715; AFOSR-87-1201TR) Avail: NTIS HC A02/MF A01 CSCL 07E

Chemiluminescene has been studied for the reactions of fluorine atoms with a range of inorganic iodides. From the form of the resulting IF(B) vibrational state distributions, it is concluded that in all F/iodide systems IF(B) is produced by the recombination of a fluorine atom with an excited iodine atom. This is supported by

the results of VUV laser-fluorescence probing and kinetic modelling. GRA

**N88-14353*#** National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
**NO2 HETERODYNE FREQUENCY MEASUREMENTS WITH A TUNABLE DIODE LASER, A CO LASER TRANSFER OSCILLATOR AND CO2 LASER STANDARDS**
L. R. Zink, M. Vanek, and J. S. Wells Apr. 1987 28 p Sponsored by NASA, Washington, D.C.
(NASA-CR-182393; NAS 1.26:182393; PB88-110051; NBS/TN-1308) Avail: NTIS HC A03/MF A01; also available SOD HC $1.50 as 003-003-02813-4 CSCL 20E

Heterodyne frequency measurements have been made on selected groups of nitrogen dioxide rovibronic transitions between 1580.8 and 1650.7/cm. The groups are separated by 7 to 10/cm, and the intent is to provide a limited (and interim) calibration table for the region. In addition to a table of measured frequencies in the region, figures of spectra in the vicinity of the measured lines are included to provide a map for identifying the transitions measured. GRA

**N83-14221#** Joint Publications Research Service, Arlington, Va.
**LASER DEVELOPMENT, EVOLUTION OF APPLIED TECHNOLOGIES DESCRIBED**
Takuzo Sato *In its* JPRS Report: Science and Technology. Japan 23 Sep. 1987 p 63-73 Transl. into ENGLISH from Optronics (Tokyo, Japan), Jan. 1987 p 86-91 (For primary document see N88-14213 06-31)
Avail: NTIS HC A05/MF A01

**N88-14558*#** Academy of Sciences (USSR), Ashkhabad.
**LIDAR INVESTIGATIONS OF M-ZONE**
O. G. Ovezgeldiyev, K. Kurbanmuradov, M. F. Lagutin, A. A. Zarudny, Yu. E. Meghel, A. A. Torba, and V. E. Melnikov (Kharkovskii Inst. Radioelektroniki, USSR ) *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 405-409 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 20E

**N88-14729#** Joint Publications Research Service, Arlington, Va.
**USE OF LASERS WITH F SUB A(II)-COLOR CENTER KCl:Li CRYSTALS IN THE INTRARESONATOR LASER SPECTROSCOPY METHOD Abstract Only**
V. M. Bayev, V. P. Dubov, A. N. Kireyev, E. A. Sviridenkov, D. D. Toptygin, and O. I. Yushchuk *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 2 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 8, Aug. 1986 p 1708-1710 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14738#** Joint Publications Research Service, Arlington, Va.
**EFFECT OF OPTICAL INHOMOGENEITIES ON SPACE COHERENCE OF RADIATION EMITTED BY LASER WITH UNSTABLE RESONATOR Abstract Only**
L. A. Danilova, D. I. Staselko, and V. L. Strigun *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 13 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 61, no. 6, Dec. 1986 p 1287-1294 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14739#** Joint Publications Research Service, Arlington, Va.
**PRODUCTION-PROCESS CO2 LASER WITH AMPLIFIED PULSE-REPETITION OPERATION Abstract Only**
A. M. Belenkiy, V. V. Vasiltsov, V. S. Golubev, A. M. Zabelin, F. V. Lebedev, P. G. Leonov, D. K. Medvedev, A. A. Morozenkov, S. K. Chekin, and R. G. Shakirov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 14 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 8, Aug. 1986 p 1720-1722 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14740#** Joint Publications Research Service, Arlington, Va.
**SUPER-SHORT YTTRIUM ALUMINATE PULSE GENERATOR WITH CONTROLLED RESONATOR Q-FACTOR Abstract Only**
A. M. Valshin, V. M. Gordiyenko, S. V. Krayushkin, V. T. Platonenko, and V. K. Popov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 14-15 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 8, Aug. 1986 p 1713-1716 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14741#** Joint Publications Research Service, Arlington, Va.
**PERIODICALLY PULSED EXCIMER MASTER OSCILLATOR-REGENERATIVE AMPLIFIER LASER SET Abstract Only**
V. P. Ageyev, V. V. Atezhev, V. S. Bukreyev, S. K. Vartapetov, A. I. Zhukov, V. I. Konov, and A. D. Savelyev *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 15 Transl. into ENGLISH from Pisma v Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 13, no. 1, 12 Jan. 1987 p 19-22 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14742#** Joint Publications Research Service, Arlington, Va.
**OBSERVING EFFECT OF LASER RADIATION OF LOW-FREQUENCY RAMAN SCATTERING OF LIGHT Abstract Only**
K. V. Grechushkin and A. V. Pivovarov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 16 Transl. into ENGLISH from Pisma v Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 45, no. 1, 10 Jan. 1987 p 8-9 Original language document was announced in IAA as A87-39052 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14753#** Joint Publications Research Service, Arlington, Va.
**DEPENDENCE OF ACOUSTICAL CHARACTERISTICS OF LASER-INDUCED BREAKDOWN IN DIELECTRIC MATERIALS ON SHAPE OF INELASTIC REGION Abstract Only**
A. Yu. Ivanov and E. A. Manykin *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 46 Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedeniy: Fizika (Tomsk, USSR), v. 29, no. 11, Nov. 1986 p 105-108 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14754#** Joint Publications Research Service, Arlington, Va.
**DEVELOPMENT OF CRACK UNDER PERIODICALLY PULSED LASER RADIATION Abstract Only**
G. Ya. Glauberman, S. V. Kondrashov, N. F. Pilipetskiy, S. Yu. Savanin, and V. V. Shkunov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 48 Transl. into ENGLISH from Zhurnal Prikladnoy Mekhaniki i Tekhnicheskoy Fiziki (Novosibirsk, USSR), no. 6(160), Nov. - Dec. 1986 p 108-110 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

## 37 MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

**N88-14354#** Cambridge Univ. (England). Dept. of Engineering.
**FILM THICKNESSES IN CIRCULAR ELASTOHYDRODYNAMIC CONTACTS**
J. A. Greenwood Sep. 1986 15 p
(PB87-123725; CUED/C-MECH/TR-37) Avail: NTIS HC E04/MF E04 CSCL 13I

It is well known that in lubricated contacts between a ball and a plane, the high pressure in the lubricant lead to enormous viscosities and to elastic deformation of the ball and the plane, and to a configuration close to that in a Hertzian (dry) contact, but with an oil thickness very much greater than that expected from classical lubrication theory. Author

**N88-14355#** Sandia National Labs., Albuquerque, N. Mex.
**EXPERIENCES IN TELEOPERATION OF LAND VEHICLES**
D. E. McGovern 1987 12 p Presented at the Spatial Displays and Spatial Instruments, Asilomar, Calif., 31 Aug. 1987
(Contract DE-AC04-76DP-00789)
(DE88-000429; SAND-87-1980C; CONF-8708156-1) Avail: NTIS HC A03/MF A01

Teleoperation of land vehicles allows the removal of the operator from the vehicle to a remote location. This can greatly increase operator safety and comfort in applications such as security patrol or military combat. The cost includes system complexity and reduced system performance. All feedback on vehicle performance and on environmental conditions must pass through sensors, a communications channel, and displays. In particular, this requires vision to be transmitted by closed circuit television (CCTV), with a consequent degradation of information content. Vehicular teleoperation, as a result, places severe demands on the operator. Experimentation studying the effects of vision-system characteristics on off-road, remote driving has been performed for conditions of fixed camera versus steering coupled camera and color versus black and white video display. Additionally, much experience has been gained through system demonstrations and hardware development trials. This paper discusses the preliminary experimental findings and the results of the accumulated operational experience. DOE

**N88-14356#** Sandia National Labs., Albuquerque, N. Mex.
**THE TRIBOLOGICAL PROPERTIES OF MoS2 COATINGS IN VACUUM, LOW RELATIVE HUMIDITY AND HIGH RELATIVE HUMIDITY ENVIRONMENTS**
J. K. G. Panitz, L. E. Pope, J. E. Lyons, and D. J. Staley 1987 16 p Presented at the 34th National Vacuum Symposium and Topical Conference, Anaheim, Calif., 2 Nov. 1987
(Contract DE-AC04-76DP-00789)
(DE88-001611; SAND-87-2025C; CONF-871125-7) Avail: NTIS HC A03/MF A01

We have RF-sputter deposited MoS2 coatings onto stainless steel plates using two extremal combinations of deposition conditions. Raman spectroscopy indicates that there is a small but significant difference in the number of sulfur-sulfur bonds and the amount of amorphous material present in the two types of coatings. The friction and wear properties were evaluated within 5 days of deposition, and after being stored for 150 days in 35 to 45 percent relative humidity followed by over 75 days in 2 percent or 98 percent relative humidity environments. For lab air testing the coefficient of friction increased with wet storage to 0.10 + or - 0.01, and the wear life decreased by a factor of three for dry storage and by a factor of ten for wet storage. The MoS2 material with the larger amount of amorphous material has a coefficient of friction of 0.10 + or - 0.013 which increased to 0.14 + or - 0.04 for storage in the wet environment. The wear life of the MoS2 coating with the greater amount of amorphous material improved significantly (by 100 percent) for storage in the wet environment. DOE

**N88-14357#** Sandia National Labs., Albuquerque, N. Mex.
**EXPERIENCES IN TELEOPERATION OF LAND VEHICLES**
D. E. McGovern Oct. 1987 14 p
(Contract DE-AC04-76DP-00789)
(DE88-001695; SAND-87-1980) Avail: NTIS HC A03/MF A01

Teleoperation of land vehicles allows the removal of the operator from the vehicle to a remote location, greatly increasing operator safety and comfort in applications such as security patrol or military combat. The cost includes system complexity and reduced system performance. All feedback on vehicle performance and on environmental conditions must pass through sensors, communications channel, and displays. In particular, this requires vision to be transmitted by closed circuit television with a consequent degradation of information content. Vehicular teleoperation, as a result, places severe demands on the operator. Teleoperated land vehicles have been built and tested by many organizations including Sandia National Laboratories (SNL). The SNL fleet includes eight vehicles of varying capability. These vehicles have been operated using different types of controls, displays, and visual systems. Experimentation studying the effects of vision-system characteristics on off-road, remote driving has been performed for conditions of fixed camera versus steering coupled camera and color versus black and white video display. Additionally, much experience has been gained through system demonstrations and hardware development trials. This paper discusses the preliminary experimental findings and the results of the accumulated operational experience. DOE

**N88-14358#** Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
**DYNAMICAL FRICTION**
G. D. Lassahn Sep. 1987 11 p
(Contract DE-AC07-76ID-01570)
(DE88-002194; EGG-SD-7822) Avail: NTIS HC A03/MF A01

A simple classical derivation of dynamical friction is given. The result allows expressing the friction term in terms of the velocity-space diffusion term in the Fokker-Planck equation. DOE

**N88-14359*** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**TOOL AND PROCESS FOR MINIATURE EXPLOSIVE JOINING OF TUBES Patent**
Laurence J. Bement, inventor (to NASA) and James W. Bailey, inventor (to NASA) 24 Nov. 1987 8 p Filed 8 Sep. 1986 Continuation-in-part of US Patent-Appl-SN-790597, filed 23 Oct. 1985
(NASA-Case-LAR-13662-1; US-Patent-4,708,280; US-Patent-Appl-SN-904812; US-Patent-Class-228-107; US-Patent-Class-228-2.5; US-Patent-Class-228-109; US-Patent-Appl-SN-790597) Avail: US Patent and Trademark Office CSCL 13H

A tool and process to be used in the explosive joining of tubes is disclosed. The tool consists of an initiator, a tool form, and a ribbon explosive. The assembled tool is a compact, storable, and safe device suitable for explosive joining of small, lightweight tubes down to 0.20 inch in diameter. The invention is inserted into either another tube or a tube plate. A shim or standoff between the two surfaces to be welded is necessary. Initiation of the explosive inside the tube results in a high velocity, angular collision between the mating surfaces. This collision creates surface melts and collision bonding wherein electron-sharing linkups are formed.

Official Gazette of the U.S. Patent and Trademark Office

**N88-14360*** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**ALIGNMENT AND ASSEMBLY TOOL FOR VERY LARGE DIAMETER CYLINDERS Patent**
James H. Ehl, inventor (to NASA) 24 Nov. 1987 9 p Filed 12 Mar. 1987 Continuation of US-Patent-Appl-SN-739788, filed 31 May 1985, abandoned
(NASA-Case-MFS-28001-2; US-Patent-4,708,330; US-Patent-Appl-SN-25039; US-Patent-Class-269-43; US-Patent-Class-269-71; US-Patent-Class-269-73; US-Patent-Appl-SN-739788) Avail: US Patent and Trademark Office CSCL 13H

An alignment and assembly tool is disclosed for aligning the ends of two very large cylinders so that the ends may be welded with a cylindrical strengthening section inserted between the cylinders and aligned and welded into the joint. The tool has a U-shaped main body with a horizontal top section and two legs, which are attached to the ends of the top section and extend outward and downward. Horizontal bottom sections extend outward

from the bottoms of two of the legs. The tool has one inner jackscrew and one outer jackscrew on each side of its center, extending downward from the top section. Each of the two bottom sections has an attached side clamp for clamping the alignment tool to two opposing skin stringers of two of the cylinders. The jackscrews are adjusted to bring the edges of a tee ring into precise alignment with the ends of the two large cylinders so that both joints may be welded around their circumference.

Official Gazette of the U.S. Patent and Trademark Office

**N88-14361*** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**DEVICE FOR MEASURING HOLE ELONGATION IN A BOLTED JOINT Patent**

Gregory R. Wichorek, inventor (to NASA) 17 Nov. 1987 6 p Filed 5 Feb. 1987 Supersedes N87-25577 (25 - 19, p 2615) (NASA-Case-LAR-13453-1; US-Patent-4,706,387; US-Patent-Appl-SN-10950; US-Patent-Class-33-147D; US-Patent-Class-73-834) Avail: US Patent and Trademark Office CSCL 13H

A device to determine the operable failure mode of mechanically fastened lightweight composite joints by measuring the hole elongation of a bolted joint is disclosed. The double-lap joint test apparatus comprises a stud, a test specimen having a hole, two load transfer plates, and linear displacement measuring instruments. The test specimen is sandwiched between the two load transfer plates and clamped together with the stud. Spacer washers are placed between the test specimen and each load transfer plate to provide a known, controllable area for the determination of clamping forces around the hole of the specimen attributable to bolt torque. The spacer washers also provide a gap for the mounting of reference angles on each side of the test specimen. Under tensile loading, elongation of the hole of the test specimen causes the stud to move away from the reference angles. This displacement is measured by the voltage output of two linear displacement measuring instruments that are attached to the stud and remain in contact with the reference angles throughout the tensile loading. The present invention obviates previous problems in obtaining specimen deformation measurements by monitoring the reference angles to the test specimen and the linear displacement measuring instruments to the stud.

Official Gazette of the U.S. Patent and Trademark Office

**N88-14362*** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

**WELDING MONITORING SYSTEM Patent**

Stephen G. Babcock, inventor (to NASA), Gerald E. Dyer, inventor (to NASA), and Stephen S. Gordon, inventor (to NASA) (Rockwell International Corp., Canoga Park, Calif.) 6 Oct. 1987 8 p Filed 5 Feb. 1987 Supersedes N87-25575 (25 - 19, p 2615) (NASA-Case-MFS-29177; US-Patent-4,698,484; US-Patent-Appl-SN-10942; US-Patent-Class-219-130.01; US-Patent-Class-219-124.34; US-Patent-Class-219-136) Avail: US Patent and Trademark Office CSCL 13I

This invention relates to systems for remotely monitoring automatic welding operations, and more particularly to a system wherein the welder is readily positionable, while components of the optical system remain fixed. A welder having an electrode is mounted in an enclosure containing a pair of mirrors. The electrode passes through an opening in the first mirror and a gas cup. The mirror reflects an image of a welding operation taken through the opening of the gas cup to the second mirror. The second mirror then reflects the image through a rotary coupling to a third mirror which, in turn, reflects the image to a receiving lense mounted to a second rotatable coupling. The image is then projected via a fiber optic bundle to a filter unit where selected wavelengths of light are filtered from the welding image. The filter unit is coupled to an enlarger which enlarges the image and passes it to a camera. The camera is connected to an electronic eclipser which selectively darkens the brightest portions of the image. Finally, the image is recorded by a video tape recorder and displayed by a monitor.

Official Gazette of the U.S. Patent and Trademark Office

**N88-14363** Texas A&M Univ., College Station.

**ROBOT ACCURACY IMPROVEMENT THROUGH KINEMATIC PARAMETER IDENTIFICATION Ph.D. Thesis**

Tsing-Wong Hsu [1987] 120 p

Avail: Univ. Microfilms Order No. DA8720905

The purpose of this research is to improve robot positioning accuracy through kinematic parameter identification. The theory of kinematic parameter identification for industrial robots is discussed. The necessary conditions for a complete and viable identification algorithm are revealed. A simple measuring device was constructed that is capable of sensing a fixed position accurately in free space. In order to facilitate hardware implementation, various measurement schemes are studied, from which a convenient procedure for data collection can be formulated. A method for determining the required precision of measuring devices and the selection of locations for data collection is realized. Dissert. Abstr.

**N88-14364#** Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

**SMALL HIGH PRESSURE RATIO TURBINES**

1987 394 p Lecture series held in Rhode-Saint-Genese, Belgium, 15-18 Jun. 1987

(VKI-LS-1987-07; ISSN-0377-3812; ETN-88-91165) Avail: NTIS HC A17/MF A01

Turbine design experience and the use of advanced design tools are described. Testing techniques and advanced calculation methods are also discussed. For individual titles, see N88-14365 through N88-14375.

**N88-14365#** Sundstrand Turbo, Pacoima, Calif.

**HIGH PRESSURE RATIO TURBINE DESIGN CONSTRAINTS**

Colin Rodgers *In* Von Karman Inst. for Fluid Dynamics, Small High Pressure Ratio Turbines 1987 30 p (For primary document see N88-14364 06-37)

(TRR-0279) Avail: NTIS HC A17/MF A01

The efficiency characteristics of inward flow radial turbines are reviewed taking account of specific speed, blade loading, and structural or manufacturing constraints. Alternate design options are addressed to provide potential performance improvements under off optimum conditions as constrained by nonaerodynamic criteria. ESA

**N88-14366#** Sundstrand Turbo, Pacoima, Calif.

**MAINLINE PERFORMANCE PREDICTION FOR RADIAL INFLOW TURBINES**

Colin Rodgers *In* Von Karman Inst. for Fluid Dynamics, Small High Pressure Ratio Turbines 1987 29 p (For primary document see N88-14364 06-37)

Avail: NTIS HC A17/MF A01

A method of estimating radial turbine efficiency and performance characteristics is presented. The method includes the expression and determination of the turbine component loss coefficients, the determination of the turbine characteristics at incidences and rotational speeds other than design, and comparisons between actual test and computed performance. The tests of an experimental low specific speed radial inflow turbine are detailed. Efficiency is predicted within 2% and flow within 3% for turbines incorporating straight backed nozzles operating at Mach numbers up to 1.2 at rotor inlet. ESA

**N88-14367#** Sundstrand Turbo, Pacoima, Calif.

**PERFORMANCE OF SUPERSONIC IMPINGEMENT RADIAL TURBINES**

Colin Rodgers *In* Von Karman Inst. For Fluid Dynamics, Small High Pressure Ratio Turbines 1987 28 p (For primary document see N88-14364 06-37)

Avail: NTIS HC A17/MF A01

The generic development path of auxiliary power units and super integrated power units used to supply secondary aircraft power and main engine start is described. An improved understanding of impingement start systems for radial inflow compressors and radial airflow turbines was obtained. Test data

for supersonic side admission impingement nozzles mounted on the stationary shrouds of a small gas turbine using single stage radial flow indicate that expansion efficiencies of the order of 40% are attainable. ESA

**N88-14368#** Pratt and Whitney Aircraft of Canada Ltd., Longueuil (Quebec).
**CONCLUSIONS FROM A RESEARCH PROGRAM ON MIXED FLOW GAS GENERATOR TURBINES**
U. Okapuu *In* Von Karman Inst. for Fluid Dynamics, Small High Pressure Ratio Turbines 1987 26 p (For primary document see N88-14364 06-37)
Avail: NTIS HC A17/MF A01

Variations of efficiency with pressure ratio and rotor design were studied. The base prototype is a 600 hp turboprop single stage aircraft engine. Rotating rig testing shows that a mixed flow turbine is capable of surpassing the aerodynamic efficiency of the axial turbine by a significant margin, and matching that of the radial turbine. Development trends are discussed. ESA

**N88-14369#** Pratt and Whitney Aircraft of Canada Ltd., Longueuil (Quebec).
**HIGHLIGHTS FROM A RESEARCH PROGRAM ON A VERY HIGHLY LOADED AXIAL GAS GENERATOR TURBINE**
U. Okapuu *In* Von Karman Inst. for Fluid Dynamics, Small High Pressure Ratio Turbines 1987 31 p (For primary document see N88-14364 06-37)
Avail: NTIS HC A17/MF A01

The highlights from an aerodynamic rig test program on a small axial turbine having unusually low blade speed are presented. It is shown that certain benefits are derived from reduced speed. Measured pressures on vane surfaces appear to agree well with analysis by an inviscid three dimensional Euler code. Agreement is inadequate on the uncovered suction surface downstream of the throat, where shock - boundary layer interaction phenomena play a major role in transonic blade rows. ESA

**N88-14370#** Pratt and Whitney Aircraft of Canada Ltd., Longueuil (Quebec).
**AERODYNAMIC DESIGN OF FIRST STAGE TURBINES FOR SMALL AERO ENGINES** **c07**
U. Okapuu *In* Von Karman Inst. for Fluid Dynamics, Small High Pressure Ratio Turbines 1987 32 p (For primary document see N88-14364 06-37)
Avail: NTIS HC A17/MF A01

Minimization of tip leakeage and limit loading are discussed. Results obtained with a 4.5:1 pressure ratio turbine having an aerodynamic loading of 2.11 indicate that very efficient turbines can be designed in loading and pressure ratio regimes of interest in the next generation of small aero engines. ESA

**N88-14371#** Pratt and Whitney Aircraft of Canada Ltd., Longueuil (Quebec).
**AERODYNAMIC TESTING OF SMALL TURBINES** **c02**
U. Okapuu *In* Von Karman Inst. for Fluid Dynamics, Small High Pressure Ratio Turbines 1987 20 p (For primary document see N88-14364 06-37)
Avail: NTIS HC A17/MF A01

A cold flow turbine rig test section was designed to simulate prototype engine inlet and outlet gas paths. A turbulence generator is incorporated at gas inlet. Second stage turbines can be tested with first stage turbines in front of them to establish the appropriate inlet conditions. Experience indicates that major differences in absolute values of measured efficiency are caused by leakages and unfavorable steps in the gas paths in the engine, and differences in tip clearance. ESA

**N88-14372#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
**NUMERICAL SIMULATION OF FLOWS IN AXIAL AND RADIAL TURBOMACHINES USING EULER SOLVERS** **c34**
Georges Meauze and Antoine Fourmaux *In* Von Karman Inst. for Fluid Dynamics, Small High Pressure Ratio Turbines 1987 56 p (For primary document see N88-14364 06-37)
Avail: NTIS HC A17/MF A01

Numerical methods for inviscid transonic flow simulation in turbomachines, particularly in high pressure ratio turbines, are reviewed. The discretization of the three dimensional Euler equations by means of an explicit predictor corrector scheme similar to the McCormack scheme is described. The method is characterized by the fact that the Euler equations are discretized directly in the physical space on an arbitrary curvilinear grid rotating with the angular velocity being a unit vector parallel to the blade row axis. The usefulness of the method is demonstrated and examples are given. ESA

**N88-14373#** Volvo Flygmotor A.B., Trollhaettan (Sweden). Mechanical Engineering Dept.
**AERODYNAMIC DESIGN AND TEST PERFORMANCE OF SUPERSONIC TURBINES FOR THE VULCAIN ROCKET ENGINE**
Hans A. Jergeus *In* Von Karman Inst. for Fluid Dynamics, Small High Pressure Ratio Turbines 1987 31 p (For primary document see N88-14364 06-37)
Avail: NTIS HC A17/MF A01

The design of supersonic turbines for the Ariane 5 rocket motor is discussed. From the specification an optimization study was carried out. Influence factors led to requirements on the turbines where functions combining turbine weight, performance, development cost, production cost, and program risk were optimized. The full scale turbine produces a specific torque 7% lower than the subscale turbine. The performance is shown to be lower for both the stator and the rotor. Deviations which may explain the reduced performance are detailed. ESA

**N88-14374#** Societe Rateau, La Courneuve (France).
**DEVELOPMENT OF A SUPERSONIC STEAM TURBINE WITH A SINGLE STAGE PRESSURE RATIO OF 200 FOR GENERATOR AND MECHANICAL DRIVE**
G. Verdonk and T. Dufournet *In* Von Karman Inst. for Fluid Dynamics, Small High Pressure Ratio Turbines 1987 55 p (For primary document see N88-14364 06-37)
Avail: NTIS HC A17/MF A01

A steam turbine with a stage pressure ratio of 200 was designed and tested. The aerodynamic design of the turbine stage is described. The main geometrical and aerodynamic parameters are discussed. The analysis of the supersonic flow in the nozzle guide vane and in the rotor is presented. Test facilities were specially built to evaluate the aerodynamic performances of the stator and rotor at design and off design conditions. An overall isentropic efficiency a little higher than the aimed value of 64.6% is reached. ESA

**N88-14375#** Societe Bertin et Cie, Plaisir (France).
**SUPERSONIC TURBINES FOR ORGANIC FLUID RANKINE CYCLES FROM 3 TO 1300 kW**
A. Verneau *In* Von Karman Inst. For Fluid Dynamics, Small High Pressure Ratio Turbines 1987 55 p (For primary document see N88-14364 06-37)
Avail: NTIS HC A17/MF A01

The design and test of supersonic axial high pressure stages in turbines using organic fluids such as Fluorinol are described. The cases studied include turbines with organic fluid Rankine cycles from 3 to 1300 kW. The design method is described. An expansion ratio of 100 with 2 axial full injection stages characterizes 1 turbine. The agreement between calculations and test results is satisfactory despite the use of relations established for subsonic flows. ESA

**N88-14376#** Technical Research Centre of Finland, Espoo. Lab. of Engineering Production Technology.
**OPTICAL SEAM TRACKING IN ROBOTIC ARC WELDING**
Juhani Annanpalo, Karri Vartiainen, Juhani Hirvonen, Pekka Kohola, and Kari Koskinen 1987 59 p In FINNISH; ENGLISH summary
(VTT-RR-463; ISBN-951-38-2801-8; ISSN-0358-5077;

ETN-88-90736) Copyright Avail: NTIS HC A04/MF A01; Technical Research Center of Finland, Espoo, Finland, Fim 58

An experimental visual seam tracking system was developed. A visual sensor is mounted on the welding head of a robot. The sensor is interfaced with the robot's control unit. Software for image processing and controlling the path of the robot during real time welding was made. The seam tracking accuracy is found to be 0.5 mm in the horizontal plane and 1 mm in the vertical plane. The system is able to adapt itself to surfaces of different brightness. Image processing is performed in the 16 bit microcomputer. An image processing speed of 8 images/sec is reached. ESA

**N88-14377** Technische Hogeschool Twente, Enschede (Netherlands).

**THE NUMERICAL SOLUTION OF THE ELASTOHYDRODYNAMICALLY LUBRICATED LINE AND POINT CONTACT PROBLEM, USING MULTIGRID TECHNIQUES Ph.D. Thesis**

Antonius Adrianus Lubrecht 1987 226 p Sponsored by Koninklijk Institut van Ingenieurs, Hogeschoolfonds van de Universiteit Twente, Netherlands, and by Stichting ter Bevordering van de Tribologie

(Grant AF-AFOSR-0127-86)

(ISBN-90-9001583-3; B8705644; ETN-88-91357) Copyright Avail: Issuing Activity

The numerical solution of the problem of elastohydrodynamic lubrication (EHL) for line and point contact conditions is treated. Applying the multigrid technique to EHL line contact equations results in a considerable reduction in computing time. A number of solutions is presented together with a film thickness formula, based on the numerical calculations and on analytical asymptotes. The so-called pressure spike can be detected, and the nature of this spike is discussed. The point contact problem is tackled and solutions for different lubricating conditions are given. The results of the line and point contact calculations are used to compute the rolling traction. The influence of different types of surface roughness geometries is investigated. ESA

**N88-14378*#** Battelle Columbus Labs., Ohio.

**INVESTIGATION OF INSTABILITY, DYNAMIC FORCES, AND EFFECT OF DYNAMIC LOADING ON STRENGTH OF CAGES FOR THE BEARINGS IN THE HIGH PRESSURE OXYGEN TURBOPUMPS FOR THE SPACE SHUTTLE MAIN ENGINE Final Report**

K. F. Dufrane, J. W. Kannel, T. L. Merriman, and A. R. Rosenfield 22 Nov. 1985 60 p

(Contract NAS8-36192)

(NASA-CR-182379; NAS 1.26:182379) Avail: NTIS HC A04/MF A01 CSCL 13K

Experiments were performed to determine the effect of cyclic loading on bearing cage strength. A long term working tensile load of approximately 1300 N (300 lbs) was found to be the likely maximum. Higher loads caused a decrease in cage tensile strength after the 125,000 cycle testing period. Poisson's ratio in compression was found to be highly dependent upon the direction of the fiberglass plies. At room temperature the value was 0.15 with the plies and 0.68 across the plies. At -196 C (-321 F), the value with the plies was 0.20. The results of the analyses conducted have again demonstrated the critical need for improved lubrication in the high pressure oxygen turbopump bearings. Lubricant films with low shear strength and low friction coefficients promote cage stability and decrease ball/cage forces during marginal operating conditions. The analysis of the effect of combined bearing loads on ball/cage loads has identified a radial load of 3600 N (800 lbs) as the maximum for the current clearance of the balls and cage pockets. Liquid oxygen impinging on the cage in the direction of rotation was found to enhance cage stability. Author

**N88-14379*#** California Univ., Los Angeles. Dept. of Chemical Engineering.

**UTILIZATION OF FEP ENERGETICS Final Report**

T. H. K. Frederking, P. Abbassi, F. Afifi, P. K. Khandhar, D. Y. Ono, and W. E. W. Chen 31 Dec. 1987 66 p

(Grant NAG2-464)

(NASA-CR-182373; NAS 1.26:182373; UCLA-ENG-8746) Avail: NTIS HC A04/MF A01 CSCL 13K

The research and development work on Fountain Effect Pump Systems (FEP systems) has been of interest in the competition between mechanical pumps for He II and FEP units. The latter do not have moving parts. In the course of the work, the energetics have been addressed using one part of a simple four-changes-of-state cycle. One option is the FEP ideal change of state at constant chemical potential (mu). The other option is the two-state sequence mu-P with a d mu=0 state change followed by an isobar. Questions of pump behavior, of flow rate response to temperature difference at the hot end, and related questions of thermodynamic cycle completion and heat transfer have been addressed. Porous media data obtained elucidate differences between vapor-liquid phase separation (VLPS) and Zero Net Mass Transfer (ZNMF). Author

**N88-14380*#** Vanderbilt Univ., Nashville, Tenn. Center for Materials Tribology.

**MECHANISMS OF ROLLING CONTACT SPALLING Final Report**

A. M. Kumar, S. M. Kulkarni, V. Bhargava, G. T. Hahn, and C. A. Rubin 30 May 1987 109 p

(Contract NAS8-36651)

(NASA-CR-179243; NAS 1.26:179243) Avail: NTIS HC A06/MF A01 CSCL 13I

The results of a study aimed at analyzing the mechanical material interactions responsible for rolling contact spalling of the 440 C steel, high pressure oxygen turbopump bearings are presented. A coupled temperature displacement finite element analysis of the effects of friction heating under the contact is presented. The contact is modelled as a stationary, heat generating, 2 dimensional indent in an elastic perfectly plastic half-space with heat fluxes up to 8.6 x 10000 KW/m sq comparable to those generated in the bearing. Local temperatures in excess of 1000 C are treated. The calculations reveal high levels of residual tension after the contact is unloaded and cools. Efforts to promote Mode 2/Mode 3 fatigue crack growth under cyclic torsion in hardened 440 C steel are described. Spalls produced on 440 C steel by a 3 ball/rod rolling contact testing machine were studied with scanning microscopy. The shapes of the cyclic, stress strain hysteresis loops displayed by hardened 440 C steel in cyclic torsion at room temperature are defined for the plastic strain amplitudes encountered in rolling/sliding contact. Results of these analyses are discussed in detail. Author

**N88-14219#** Joint Publications Research Service, Arlington, Va.

**DEVELOPMENT, FEATURES OF ROLLER ROCKER ARM REPORTED**

*In its* JPRS Report: Science and Technology. Japan 23 Sep. 1987 p 34-36 Transl. into ENGLISH from Nainei Kikan (Tokyo, Japan), Jun. 1987 p 47-52 (For primary document see N88-14213 06-31)

Avail: NTIS HC A05/MF A01

**N88-14858*#** Texas Southern Univ., Houston. Dept. of Computing and Applied Sciences.

**HEURISTIC CONTROL OF THE UTAH/MIT DEXTROUS ROBOT HAND Final Report**

Andrew H. Bass, Jr. *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 20 p (SEE N88-14855 06-85)

Avail: NTIS HC A15/MF A01 CSCL 13I

**N88-14876*#** Texas A&I Univ., Kingsville. Dept. of Civil and Mechanical Engineering.

**DYNAMICS, CONTROL AND SENSOR ISSUES PERTINENT TO ROBOTIC HANDS FOR THE EVA RETRIEVER SYSTEM Final Report**

Robert A. McLauchlan *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 20 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 13I

# 38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

No abstracts in this category.

# 39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

**N88-14381#** Virginia Univ., Charlottesville.
**FATIGUE 87, VOLUME 2 Final Report, 1 Jun. 1987 - 1 May 1988**
R. O. Ritchie, ed. and E. A. Starke, Jr., ed. 1987 564 p Presented at the Third International Conference on Fatigue and Fatigue Thresholds, Charlottesville, Va., 28 Jun. - 3 Jul. 1987
(Grant DAAL03-87-G-0102)
(AD-A184046; ARO-24134.2-MS-CF-Vol-2) Avail: NTIS HC A24/MF A01 CSCL 20K

A wide range of diverse views on the fundamental and applied aspects of fatigue were discussed. Questions of cyclic deformation, crack initiation and propagation, small cracks, crack closure, variable amplitude effects, and environmentally induced behavior were discussed. For individual titles, see N88-14382 through N88-14432.

**N88-14382#** Illinois Univ., Urbana-Champaign. Dept. of Mechanical and Industrial Engineering.
**FATIGUE DAMAGE MAPS**
Darrell F. Socie *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 599-616 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Observations of fatigue crack nucleation and early growth are presented. The state of stress/strain was shown to play a significant role in this process. Early crack growth occurs on planes experiencing the largest range of shear strain or normal strain depending on stress state, strain amplitude and microstructure. These observations were summarized on a fatigue damage map for each material. Extension of fatigue damage maps to complex loading is presented. Author

**N88-14383#** Central Electricity Research Labs., Leatherhead (England). Technology Planning and Research Div.
**AN INVESTIGATION OF FATIGUE CRACK GROWTH IN A DUCTILE MATERIAL AT HIGH GROWTH RATES**
K. J. Nix, N. Knee, T. C. Lindley, and G. G. Chell *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 617-626 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

An investigation was made of fatigue crack growth in a ductile steel in the high growth rate regime where ductile tearing can contribute to crack growth. A computerized testing system for a servo-hydraulic testing machine was developed to enable controlled fatigue testing in this regime. Results for three point bend specimens of mild steel indicate that a crack growth model in which the fatigue and ductile fracture contributions are considered additive and non-interactive provides a satisfactory method for predicting crack growth rates. Author

**N88-14384#** Karlsruhe Univ. (West Germany). Inst. fuer Werkstoffkunde.
**CYCLIC DEFORMATION BEHAVIOUR OF CAST IRONS WITH VARIOUS GRAPHITE SHAPES IN THE TEMPERATURE RANGE 20 C LESS THAN OR = T LESS THAN OR = 500 C**
K. H. Lang, D. Eifler, and E. Macherauch *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 627-636 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Stress and strain controlled push-pull tests were performed in a fully computerized servohydraulic test system between 20 C and 500 C with smooth specimens of nodular graphite cast iron, vermicular graphite cast iron and flake graphite cast iron. The plastic strain amplitudes were measured and recorded with an on-line computer system. The material behavior was described by cyclic deformation curves. Supplementary transmission electron microscope investigations were carried out. Characteristic experimental results are presented and discussed. Author

**N88-14385#** Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.
**FATIGUE CRACK GROWTH AND FRACTURE OF COPPER-BISMUTH BICRYSTALS**
S. Chikwembani and J. Weertman *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 637-644 (For primary document see N88-14381 06-39)
(Grant NSF DMR-83-04644)
Avail: NTIS HC A24/MF A01 CSCL 20K

Copper doped with bismuth bicrystals show fatigue crack growth along the boundary for bulk bismuth contents higher than about 0.003 wt. percent. At a given delta kappa, da/dN increases with increasing bismuth concentration (i.e., da/dN increases with decreasing surface energy). Overload effects in the bicrystals are so prominent that they could easily swamp the effects of changes in bismuth concentration. The Paris equation power exponent m is found to increase with increasing bismuth concentration.
Author

**N88-14386#** Goodrich (B. F.) Co., Akron, Ohio.
**LIFE PREDICTION OF STEEL CORDS**
A. Prakash, G. A. Costello (Illinois Univ., Urbana.), R. M. Shemenski, and D. K. Kim *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 645-654 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Steel cables are used under cyclic tension and bending loading. Usually, failures have been attributed to fatigue accelerated by fretting and corrosion. Bending and axial stresses in a typical cable are presented. Low cycle fatigue characterization was carried out for cyclic bending loading over a fixed cord tension. Bending low cycle fatigue behavior correlates with the cable's bend hysterisis property. Author

**N88-14387#** Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.
**EFFECT OF HOLD TIME ON FATIGUE OF LEAD RICH PbSn SOLDER**
S. Vaynman, M. E. Fine, and D. A. Jeannotte (International Business Machines Corp., Hopewell Junction, N. Y.) *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 655-666 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

The effect of tensile and compression hold times on the fatigue life of lead rich PbSn solder was studied. Tensile and combined tensile and hold times were found to reduce dramatically the number of cycles to failure. A simple mathematical relation between the isothermal fatigue life and tensile and compressive hold times was developed. Author

**N88-14388#** Central Iron and Steel Research Inst., Beijing (China). Dept. of Physical Metallurgy.
**ON CLEAVAGE IN FATIGUE FOR RAIL STEELS**
Dong Zhu, Qigong Cai, and Heng Yao *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 667-676 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

The cleavage during fatigue of rail steels was studied. Th effect of strain rate and microstructure on the fatigue crack propagation rate was examined. Cleavage burst occurred frequently in front of the notch. The cleavage in fatigue was a statistical occurrence; the probability increased with the strain rate and the radius of crack tip within a certain range. Author

**N88-14389#** Ecole Polytechnique, Montreal (Quebec). Dept. de Genie Metallurgique.
**INFLUENCE OF CLEAVAGE ON FATIGUE PROPAGATION RATES IN A LOW CARBON STEEL**
Y. Blanchette, J. I. Dickson, and J. P. Bailon *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 677-686 Sponsored in part by FCAR, Quebec and National Sciences and Engineering Research Council, Canada (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

A study of crack propagation in an SAE-AISI 1005 steel showed that at 233 and 173 K, patches of cleavage occurred during crack propagation with the amount of cleavage determined largely by delta kappa and by the cyclic crack tip plasticity. Sufficient cleavage occurred at 173 K to result (near delta kappa = 20 MPa square per square meter) in a change in the exponent m of the Paris-Erdogan relationship. This enhanced crack propagation was explained by stress transfer to the uncracked ligaments in the neighborhood of the cleaved patches and was modeled by the presence of a semi-cohesive zone and by its influence on the crack tip opening displacement. Author

**N88-14390#** Academy of Sciences (USSR), Kiev. Inst. for Problems of Strength.
**EFFECT OF METAL SURFACE PROPERTIES ON THE FATIGUE CRACK GROWTH BEHAVIOR**
A. V. Prokopenko and V. N. Torgov *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 687-696 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

A model of metal fatigue fracture behavior for a lower local yield stress on the surface as compared to the macroscopic yield stress was formulated and verified experimentally. The model makes it possible to calculate the fatigue limit based on the critical size of the nonpropagating crack in cyclic bending, and tension-compression at different stress ratios in a cycle for notched and unnotched elements, taking into account residual stresses. The model is used for the analysis of short crack growth. Author

**N88-14391#** Mitsubishi Electric Co., Amagasaki (Japan). Central Research Lab.
**FATIGUE CRACK GROWTH BEHAVIOR IN HYDROGEN GAS ENVIRONMENT**
S. Yoshioka, M. Kumasawa, M. Demizu, and A. Inoue *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 697-706 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Fatigue crack growth behavior in a hydrogen gas environment was examined using compact tension specimens of low alloy steel, austenitic alloy steels, and a copper alloy. Fatigue crack growth rates in laboratory air and in hydrogen gas were obtained and the relation between fatigue crack growth rate and fracture morphology was discussed based on fractographical observations. Author

**N88-14392#** Ceskoslovenska Akademie Ved, Brno. Inst. of Physical Metallurgy.
**NEAR-THRESHOLD FATIGUE**
P. Lukas *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 719-738 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

The mechanisms of the near-threshold, high cycle fatigue and the nature of the fatigue limit are discussed on the basis of experimental data concerning the effect of grain size and temperature on the cyclic stress-strain response, fatigue life, fatigue crack growth, and dislocation structures in copper. The interpretation of the fatigue limit as a short crack propagation threshold made it possible to derive simple engineering formulas for the calculation of the size and sharpness of the non-damaging notches and for the description of the effect of small notches on fatigue strength. Author

**N88-14393#** Kyoto Univ. (Japan). Dept. of Engineering Science.
**NOTCH-GEOMETRY EFFECT ON PROPAGATION THRESHOLD OF SHORT FATIGUE CRACKS IN NOTCHED COMPONENTS**
K. Tanaka and Y. Akiniwa *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 739-748 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

A consistent method was proposed to predict the fatigue threshold of notched components by combining crack closure with the micromechanical criterion for crack growth. The predictions of the effects of notch tip radius and notch depth on the propagation threshold of short fatigue cracks was compared with the experimental results obtained with notched specimens of low-carbon steels. Good agreement was found between predictions and experiments. Author

**N88-14394#** Coimbra Univ. (Portugal). Engenharia Mecanica.
**INFLUENCE OF CRACK CLOSURE ON FATIGUE CRACK PROPAGATION AND THRESHOLD**
A. Dias, A. Bignonnet, and H. P. Lieurade (Institut de Recherche de la Siderurgie, Saint-Germain-en-Laye, France ) *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 749-758 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

The effects of load ratio, R, and test frequency upon closure were investigated for a wide range of materials. The crack opening stress intensity factor, K sub op, was evaluated as a function of delta kappa, R and test frequency. It was found that at the intermediate growth rate regime of the Paris plot, K sub op is independent of delta kappa, R and test frequency. A conservative estimation of the threshold values from the crack opening stress intensity level delta kappa sub th =(1-R).K sub op is possible. Author

**N88-14395#** Ecole Polytechnique, Montreal (Quebec). Dept. de Genie Metallurgique.
**AN EXPLANATION OF THE FRACTOGRAPHY OF NEAR-THRESHOLD FATIGUE IN FCC METALS**
J. I. Dickson, Shiqiong Li, and J. P. Bailon *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 759-768 Sponsored in part by National Sciences and Engineering Research Council, Canada and FCAR, Quebec (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Fractographic features associated with fatigue cracking at low da/dN values in f.c.c. metals can be explained by fine scale decohesion on slip planes, with the crystallographic and fractographic details determined essentially by the number of slip planes on which decohesion occurs, their relative orientations with respect to the average orientation of the local fracture plane and by the relative amount of decohesion on each slip plane. Author

**N88-14396#** Xian Jiaotong Univ. (China). Research Inst. for Strength of Metals.
**THE RELATIONSHIP BETWEEN MICROSTRUCTURAL SIZE AND FATIGUE THRESHOLD IN IRON AND STEEL**
Haicheng Gu and Liu Xiao Du *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 769-778 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Fatigue crack growth at the near threshold region was studied in pure iron, medium carbon and high carbon steels, and austenic

steel. The front profile of crack tip, the height of asperities on fatigue fracture surfaces, and the crack closure were found to be influenced by microstructure. The results are explained in terms of mechanical component sigma gamma incorporated with microstructural size d with concept of reversed plastic zone. This criterion is unique for steels with different microstructures: ferrite, pearlite, austenite, martensite and bainite. Author

**N88-14397#** Witwatersrand Univ., Johannesburg (South Africa). Dept. of Metallurgy and Materials Engineering.
**THRESHOLD BEHAVIOUR OF SEMI-ELLIPTIC HYDROGEN-INDUCED AND FATIGUE-INDUCED CRACKS**
M. N. James *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 779-788 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Threshold data is examined for small semi-elliptic fatigue cracks initiated in the region of bulk plasticity and then stress relieved, for hydrogen-induced cracks and for fatigue cracks initiated and grown in a nominally elastic field. Author

**N88-14398#** Wien Univ. (Austria).
**EFFECT OF COMPRESSIVE PORTION OF LOADING CYCLES ON THE NEAR THRESHOLD FATIGUE CLOSURE BEHAVIOR**
Heinrich Kemper, Brigitte Weiss, and Roland Stickler *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 789-799 Sponsored in part by the Fonds zur Foerderung der Wissenschaftlichen Forschung, Vienna, Austria and the Bundesministerium fuer Wissenschaft und Forschung, Vienna, Austria (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

The influence of the compressive portion of loading cycles on the near-threshold fatigue crack growth and closure behavior was investigated for pure Cu, conventionally processed Al 2024-T3 and the mechanically alloyed Al-Mg-Li alloy IN-905XL. Measurements were carried out for stress ratios between -2 less than R less than 0.6 at 50 Hz at room temperature. The interrelationship between K sub max, K sub op and R ratio indicates for each material the existence of a characteristic critical compressive stress only below which closure effects become negligible, i.e., delta kappa sub th, eff equals K sub max. Author

**N88-14399#** Newcastle Univ. (Australia). Dept. of Mechanical Engineering.
**ABSOLUTE FATIGUE THRESHOLDS IN METALLIC MATERIALS**
J. A. Lewis *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 801-808 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Fatigue studies in the near threshold region on a range of materials show the existence of an absolute fatigue crack propagation threshold and an upper-bound fatigue crack propagation rate. These are observed when the fatigue testing conditions are such that transient effects associated with plasticity-induced crack closure are removed. Under these conditions, multilinear da/dN-delta kappa curves were observed in Ti-8Al-1Mo-IV alloy, and type 303 stainless steel as well as aluminum alloys 7005-T591 and 5083-H321. Coincidental relationships were noted between the transition points and specific growth rates in these three material types. Author

**N88-14400#** Essen Univ. (West Germany). Werkstofftechnik.
**THERMOMETRICAL INVESTIGATIONS ON THE NEAR THRESHOLD FATIGUE CRACK PROPAGATION BEHAVIOR**
K. Mueller and H. Harig *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 809-818 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Thermocouple measurements during monotonic and cyclic deformation were carried out. By means of the thermoelastic effect and the dissipation of work done during deformation, a thermometrical method is described which allows the separate registration of the elastic and plastic deformation parts. By using this investigation method, the crack opening load and stress arrangement during crack growth near the threshold value can be determined. Author

**N88-14401#** Lehigh Univ., Bethlehem, Pa. Dept. of Materials Science and Engineering.
**A RE-EVALUATION OF FATIGUE THRESHOLD TEST METHODS**
W. A. Herman, R. W. Hertzberg, C. H. Newton, and R. Jaccard (Swiss Aluminum Ltd., Zurich.) *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 819-828 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

By varying the K-decreasing test procedure, threshold behavior was developed at significantly different stress intensity levels in both 2024-T3 aluminum and Astroloy nickel base alloy. The threshold associated with low R-ratio delta kappa-decreasing test conditions is believed to represent a non-conservative measurement of the material's fatigue resistance at low K levels. It is recommended that high R-ratio or constant Kmax K-decreasing test methods be used to characterize fatigue threshold behavior. Implications regarding the comparison of short crack FCP rates with data determined from such test methods are discussed. Author

**N88-14402#** Kogakuin Univ., Tokyo (Japan). Dept. of Chemical Engineering.
**THE FACTORS WHICH GOVERN THE ACCELERATION OF CORROSION FATIGUE CRACK GROWTH RATE OF A FERRITIC STAINLESS STEEL**
Y. Kimura, T. Yagasaki, and T. Kunio (Keio Univ., Yokahama, Japan ) *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 829-838 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Fatigue tests were mainly conducted in 0.03 percent and 3 percent NaCl aqueous solutions with WOL type specimens of a ferritic stainless steel AISI 405. The contribution of the anodic dissolution and the hydrogen embrittlement mechanisms toward the acceleration of the fatigue crack growth rate in solution is discussed. The anodic dissolutive effect is dominant for the crack growth rate acceleration within the lower delta kappa sub eff value range. On the contrary, brittle mode fracture becomes important within higher delta kappa value ranges. Furthermore, these factors have two different kinds of dependencies upon chloric ion concentration. Author

**N88-14403#** Lucas (Joseph) Ltd., Solihull (England). Research Centre.
**FATIGUE THRESHOLDS OF C.Mn STEELS IN SALINE ENVIRONMENTS**
P. R. G. Anderson, R. Brook, and C. E. Nicholson (Health and Safety Executive, Sheffield, England ) *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 839-850 Sponsored in part by the Health and Safety Executive, Sheffield, United Kingdom (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

The fatigue threshold, delta kappa sub th, and the near threshold crack growth of C.Mn constructional steel (in two heat treated conditions) were determined in a series of aqueous saline solutions, one of which also contained hydrogen sulfide. Tests were made in three-point bending at about 100Hz and at R ratios of 0.15, 0.3 and 0.6 using a computer controlled test facility. Compared with air, the saline environments slightly reduce delta kappa sub th and the effect of R. The presence of H sub 2 S apparently has no significant effect on delta kappa sub th but increases crack growth rates at higher delta K values. Measurement of crack growth by dcpd becomes inaccurate due to the effect of conductive corrosion products in the crack. Author

**N88-14404#** Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
**A MODEL FOR ULTRA-LOW FATIGUE CRACK GROWTH**
J. C. Radon and L. Guerra-Rosa (CEMUL, Lisbon, Portugal ) *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 851-860 (For

primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

A model was derived to predict the true threshold value for fatigue crack growth in the absence of crack closure. The model, based only on the tensile and cyclic properties of the material was successfully verified against a set of experimental data on a typical structural steel. Good agreement with experimental results was obtained. Author

**N88-14405#** Xian Jiaotong Univ. (China). Research Inst. for Strength of Metals.
**INFLUENCE OF STRESS RATIO R ON FATIGUE THRESHOLD DELTA K(th) FOR 40Cr STEEL**
Nian Li and Bai-Ping Du *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 861-868 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

The influence of stress ratio R on fatigue threshold delta kappa sub th in 40 Cr steel is studied. Results showed that the decrease in delta kappa sub th with increasing R can not be entirely explained by crack closure effect and that there is the influence of mean stress. Author

**N88-14406#** Gifu Univ. (Japan). Dept. of Mechanical Engineering.
**THE EFFECTS OF LOADING HISTORY ON FATIGUE CRACK GROWTH THRESHOLD**
T. Ogawa, K. Tokaji, S. Ochi, and H. Kobayashi (Tokyo Inst. of Tech., Japan ) *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 869-878 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

The effects of loading histories on threshold stress intensity factor range (delta kappa sub th) were investigated in two steels. A single overloads and multiple overloads were chosen as loading histories. The delta kappa sub th values determined as a fatigue limit of preloaded specimens increased with increasing overload stress intensity (K sub h). For a given K sub h value, it was found that multiple overloads produced a much larger increase in delta kappa sub th than single overloads and that threshold values expressed by the maximum stress intensity factor (K sub max,th) were almost constant, independent of load ratio. The results obtained are discussed in terms of crack closure behavior, and a method is proposed to evaluate threshold value, based on plasticity induced closure. Author

**N88-14407#** Ruhr Univ., Bochum (West Germany). Inst. fuer Werkstoffe.
**THRESHOLD STRESS INTENSITY FOR STABLE CRACK GROWTH IN HIGH STRENGTH STEEL AT AMBIENT TEMPERATURE AND BELOW**
L. Weber *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 879-888 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Fatigue loading of unnotched surface treated specimens leads to crack initiation and subsequent crack growth until failure. Compressive residual stresses at the surface increase the time to crack initiation, while they may stop a crack in subsurface layers due to a reduction of the stress intensity at the crack tip. Notched specimens without induced residual stresses show the influence of the ultimate tensile strength and the temperature on the threshold value of stable crack growth. Author

**N88-14408#** Technische Hogeschool, Delft (Netherlands). Dept. of Materials Science.
**THE EFFECT OF SHEAR LIPS ON FATIGUE CRACK GROWTH IN Al-2024 SHEET MATERIAL**
J. Zuidema and H. S. Blaauw *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 889-898 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Fatigue crack growth experiments were performed on center cracked specimens of Al-2024 T351. Experiments under constant stress intensity were carried out for two plate thicknesses. A very accurate technique was used to measure the shear lip width as a function of the crack length. It requires some length of crack before an equilibrium width of shear lips is reached. Both the steady and the non-steady state is described. The results are used to explain the crack growth behavior. Author

**N88-14409#** Westinghouse Research Labs., Pittsburgh, Pa. Materials Analysis Dept.
**NEAR-THRESHOLD FATIGUE CRACK GROWTH BEHAVIOR AT CRYOGENIC TEMPERATURE**
P. K. Liaw and W. A. Logsdon *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 899-910 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Near-threshold fatigue crack growth behavior of a nickel base alloy (Inconel 706) and a stainless steel (JBK-75) were developed at cryogenic temperatures as low as liquid helium temperature (4.2K). Decreasing the temperature from 297 to 4.2K decreased the influence of R-ratio on the rates of near-threshold crack propagation in both materials. In particular, the R-ratio effect at 4.2K was marginal. The lack of oxide and roughness induced crack closure at low temperatures was thought to be the reason for the decreased R-ratio effect. Decreasing the temperature from 297 to 4.2K decreased the crack propagation rates in both materials. Crack closure cannot account for the effect of temperature on crack growth behavior. Dislocation dynamics has to be used to explain the temperature effect. Author

**N88-14410#** Tohoku Univ., Sendai (Japan). Dept. of Mechanical Engineering 2.
**THE EFFECT OF NON-METALLIC INCLUSIONS ON FATIGUE AND FATIGUE THRESHOLDS OF 25Mn-5Cr-1Ni STEEL**
I. Maekawa, J. H. Lee, and S. Nishida (Nippon Steel Corp., Kita-Kyushu, Japan ) *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 911-920 Sponsored in part by the Ministry of Education, Japan (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Fatigue, tensile and Charpy experiments were performed using four series of high manganese steels which were specially prepared by changing the inclusion contents. Fatigue lives of these steels were found to increase at low temperatures and by increase of inclusion content. A staircase pattern was observed around an inclusion on a fracture surface. Such a rugged surface seems to act as an arrester for crack propagation. Threshold stress intensity factor, crack growth rate, elastic-plastic fracture toughness and Charpy value were reduced by an increase of sulphide inclusion content. Author

**N88-14411#** Lille Univ. (France). Lab. de Metallurgie Physique.
**ROLE OF INTERSTITIALS AND PRECIPITATES IN INITIATION AND PROPAGATION OF L.C.F. CRACKS IN AUSTENITIC STAINLESS STEELS**
S. Degallaix and J. Foct *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 921-932 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Low cycle fatigue tests were carried out at 20 C on two steels (316L and 316LN respectively) either water quenched or previously aged at 600 C. Measurements of the striation spacing on the rupture surfaces lead to measurement of the crack growth rate da/dN as a function of crack depth a. The influence of the nitrogen content and of the precipitation (either inter- or intragranular) due to previous aging is analyzed with regard to the various crack growth stages observed. Author

**N88-14412#** Oesterreichische Akademie der Wissenschaften, Leoben. Inst. fuer Festkoerperphysik.
**THRESHOLD AND CRACK-GROWTH TESTS ON PRE-CRACKED SPECIMENS PRODUCED IN CYCLIC COMPRESSION**
R. Pippan *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 933-940 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

The fatigue crack growth rate in tension-tension fatigue (R=0.1) was measured in specimens pre-cracked in cyclic compression. The material used was ARMCO iron. At the beginning, the growth rate of a closure free crack was observed. With an increase of crack length, the growth rate decreases. For delta kappa less than delta kappa sub th, a crack arrest occurs. For delta kappa more than K sub th, the growth rates converge to the conventionally measured da/dN values. The distance over which crack closure develops can be estimated. By step-wise increases of the load amplitude by specimens pre-cracked in cyclic compression, delta kappa sub eff th and delta kappa sub th were measured. Author

**N88-14413#** California Univ., Los Angeles. Dept. of Civil Engineering.
**MICROMECHANICS OF FATIGUE CRACK INITIATION UNDER AXIAL AND TORSIONAL LOADINGS**
T. H. Lin, S. R. Lin, and W. U. Cooley (Hughes Aircraft Co., El Segundo, Calif.) *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 941-950 (For primary document see N88-14381 06-39)
(Contract N00014-86-K-0153)
Avail: NTIS HC A24/MF A01 CSCL 20K

The micromechanic theory of fatigue crack initiation under axial loading (tension and compression) is reviewed. The same approach is applied to combined cyclic axial and torsional loadings. The component of intrusion depth normal to the free surface is taken as a measure of crack initiation. It is found that the rate of crack growth per cycle of loading varies more than linearly with the magnitude of alternate loading. Author

**N88-14414#** Xian Jiaotong Univ. (China). Research Inst. for Strength of Metals.
**STUDY OF THE CHARACTERISTIC CURVE OF HARDENING AND SOFTENING DURING LOW-CYCLE FATIGUE PROCESS**
Xinzeng Chen, Zhongxin Fen, Jianzhong Zhang, and Huifen Chai *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 951-958 Sponsored in part by Karlsruhe Univ., West Germany and the Chinese Academy of Sciences (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

The epsilon a.p-N curve measured over the whole gauge length really represents the relative rate of plastic strain spreading rate and the crack initiation rate, rather than the hardening or softening behavior of materials during fatigue. The hardening can appear in epsilon a.p-N curves when the plastic strain spreads to the whole gauge length of the specimen before the crack initiates. Otherwise, there will be no hardening. The factors, which favor the expansion of plastic strain and restraint of crack initiation, can promote the appearance of hardening. Author

**N88-14415#** Nottingham Univ. (England). Dept. of Metallurgy and Materials Science.
**THE EFFECT OF PRESTRAINING ON FATIGUE CRACK GROWTH IN NICKEL-BASE ALLOYS**
J. M. Kendall, M. A. Hicks (Rolls-Royce Ltd., Derby, England ), and J. E. King *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 959-968 Sponsored in part by SERC, United Kingdom (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

The effect of prestrain on near-threshold fatigue crack growth in the nickel-base alloy, N901, was examined at 20 C and 600 C. Prestraining was carried out in tension at room temperature, producing planar dislocation arrays. Fatigue crack growth rates were slightly higher and threshold values lower in prestrained material than in as-received material, with most effect at 20 C and at low load ratios. Planar facets were observed on the fatigue fracture surfaces of prestrained material. The results are discussed in terms of the interaction of dislocations in the reversed plastic zone with the artificially introduced dislocation arrays. The effect of prestraining on fatigue crack closure is considered. Author

**N88-14416#** Metz Univ. (France). Lab. de Fiabilite Mecanique.
**MIXED MODE FATIGUE CRACK GROWTH USING THE BRASILIAN DISC**
M. Louah, G. Pluvinage, and A. Bia *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 969-978 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Mixed mode fatigue crack growth was studied using a Brazilian disc. The sample was chosen because of machining easiness and for the possibility of a continuous variation of the K1/K2 ratio. It is necessary to define an equivalent straight crack which allows the computation of K1/K2 according to the Atkinson formula. In this study, it is seen that the bifurcation angle follows the maximum circonferential stress criterion. It was also concluded that to define fatigue crack growth, a new equivalent stress intensity factor range is necessary. Author

**N88-14417#** Northeastern Univ., Boston, Mass. Dept. of Mechanical Engineering.
**CRACK CLOSURE PHENOMENA IN MODES 1 AND 2 INTERACTIONS**
H. Nayeb-Hashemi, S. S. Hwang, and P. G. Poles *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 979-996 Sponsored in part by NSF, Washington, D.C. and Army Materials and Mechanics Research Center, Watertown, Mass. (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Many mechanistic models for the effects of the load history on Mode 1 crack growth have been suggested. However, the application and validity of these models in the case of other mode interactions (Modes 2 and 3) are not explored. Here, the effects of Mode 1 and 2 interactions are studied and the validity of those models on subsequent Mode 1 crack growth is investigated. Author

**N88-14418#** Ecole Polytechnique, Palaiseau (France). Lab. de Mecanique des Solides.
**MULTIAXIAL FATIGUE FAILURE CRITERION: A NEW APPROACH**
K. Dang Van and Y. V. Papadopoulos *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 997-1008 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

A new version of fatigue failure criterion is presented. In this criterion, local microscopic stresses associated with the stabilized microscopic stress cycle are used. This new theory is applied to Nishihara-Kawamoto tests of out-of-phase bending and torsion. Correlation of experimental results with theoretical predictions is quite good. Author

**N88-14419#** Stanford Univ., Calif. Dept. of Mechanical Engineering.
**PROFILES OF SELF STRESS AND OF LOAD STRESS AT NOTCHES**
H. O. Fuchs and S. B. Lee (Korean Inst. of Machinery and Metals, Seoul.) *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 1009-1020 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

The reduction of fatigue strength by notches can be mitigated or cancelled by suitable surface treatments. Analysis of these effects requires consideration of the profiles of stresses below the surface of notches. An example of optimization by such analysis is shown. Approximations to stress profiles and sources of stress profiles are presented. Author GR

**N88-14420#** Metz Univ. (France). Faculte des Sciences.
**FATIGUE OXIDATION INTERACTION IN LOW CYCLE FATIGUE**
M. Lebienvenu, Z. Azari, and G. Pluvinage *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 1021-1026 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Fully reversed axial strain cycling tests were performed at 610 C on smoothed specimens of 20CD10-05 steel. Fatigue resistence and its temperature dependency are discussed, based on the plastic strain range vs. fatigue life diagrams. The fatigue oxidation

interaction was defined by quantifying the influence of mechanical cycling on the oxidation process in high temperature low cycle fatigue. Particular emphasis is placed on the influence of the environment on the crack initiation stage of fatigue cracks in relation to the microstructure. Author

**N88-14421#** Indian Inst. of Science, Bangalore. Dept. of Aerospace Engineering.
**EFFECT OF TEMPERATURE EXPOSURE ON FATIGUE CRACK PROPAGATION**
K. K. Brahma, B. Dattaguru, and R. Sunder (National Aeronautical Lab., Bangalore, India ) *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 1027-1036 Sponsored in part by the Ministry of Defence, India (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

An experimental study of the effect of temperature exposure between blocks of constant K sub max loading on fatigue crack propagation is carried out on Al-Cu-Mg alloy. The study attempts to explain the effects through crack closure phenomena. The crack closure measurements are carried out through electron microscopy. The results indicate that the temperature exposure does significantly decrease the crack closure/opening stress and increase the fatigue crack propagation rate. Author

**N88-14422#** Consiglio Nazionale delle Ricerche, Milan (Italy).
**HIGH TEMPERATURE LOW CYCLE FATIGUE OF OXIDE DISPERSION STRENGTHENED AND SINGLE CRYSTAL NICKEL BASE SUPERALLOYS**
M. Marchionni, V. Catena (Fiat Aviazione S.p.A., Turin, Italy ), and D. Ranucci *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 1037-1046 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

High temperature mechanical strength of an oxide dispersion strengthened alloy is compared with that of a single crystal alloy. The results show that a single crystal alloy exhibits a lower elasticity modulus and higher ductility in the temperature range 850 C to 1050 C. The cyclic curves of the ODS alloy are softening when strain is lower than 0.4 to 0.8 percent and hardening at higher strains. The single crystal alloy shows hardening behavior at higher temperatures and softening behavior at 850 C. The curves of fatigue life show that the single crystal alloy exhibits a higher fatigue endurance than that observed in the ODS alloy for all the test conditions. Author

**N88-14423#** Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
**ORIENTATION EFFECTS IN COPPER SINGLE CRYSTALS FATIGUED AT ELEVATED TEMPERATURES**
L. L. Lisiecki, F. Boehme, and J. R. Weertman *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 1047-1056 Sponsored in part by Owens-Corning Fiberglas Corp. and Guggenheim Foundation, N.Y. (For primary document see N88-14381 06-39)
(Grant NSF DMR-82-16972)
Avail: NTIS HC A24/MF A01 CSCL 20K

Copper single crystals oriented for one of three different double slip possibilities were fatigued at 250 C or 405 C (1/2 T sub m). The dominant dislocation reactions expected in the three orientations lead to the production of sessile jogs, Lomer locks or cells formed by coplanar slip. After fatiguing at 250 C, persistent slip bands (PSB), veins and cells are seen; at 450 C only cells are seen. A plateau in the saturation stress is present at 250 C, but not at 405 C. The various strengthening mechanisms (jogs, Lomer locks, cells) differ markedly in their response to increasing temperature. Author

**N88-14424#** Naval Research Lab., Washington, D.C. Material Science and Technology Div.
**ELEVATED TEMPERATURE FATIGUE CRACK PROPAGATION**
D. J. Michel and A. W. Thompson (Carnegie-Mellon Univ., Pittsburgh, Pa.) *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 1057-1066 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

The effects of environment and hold time on the crack propagation behavior of austenitic stainless steel were examined as part of an effort to couple the available experimental fatigue and creep fatigue results with the microstructural observations concerning the mode and character of crack propagation. The examination suggested that the primary contributions to the crack propagation process included the cyclic deformation, the thermally-activated, time dependent tensile creep and the time dependent environmental effects. A phenomenological approach incorporating these contributions was used to construct a model of the crack propagation behavior. The development of the model is discussed and experimental and model results are compared for 316 stainless steel. Author

**N88-14425#** Brown, Boveri und Cie, A.G., Baden (Switzerland). Metallurgical Lab.
**HIGH TEMPERATURE LOW CYCLE FATIGUE BEHAVIOR AND CREEP-FATIGUE INTERATION OF MA 6000 ODS ALLOY**
M. Nazmy, W. Ebeling, and M. Staubli *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 1067-1076 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

The high temperature low cycle fatigue (HTLCF) behavior, under different types of strain wave shapes, in the oxide dispersion strengthened (ODS) alloy MA 6000 was investigated at 950 C. The cycles with tensile hold times were the most effective regarding the internal damage. Three models for the HTLCF lifetime were evaluated for their ability to correlate the fatigue data on MA 6000. These models are strain range partitioning (SRP), the frequency separation (FS) and the frequency modified damage function (FMDF). In general, the three models correlated the HTLCF data relatively well. Author

**N88-14426#** Central Electricity Generating Board, Bristol (England). Scientific Services Dept.
**CREEP-FATIGUE CRACKING IN HIGH TEMPERATURE TURBINE ROTORS**
A. T. Stewart, D. A. Miller, D. C. Martin, and G. Wigmore *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 1077-1086 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

The mechanisms by which creep-fatigue damage can arise in high temperature rotors in power plants are presented. Different failure modes are described. Life prediction methods based on life fraction and ductility exhaustion techniques of damage summation are described and applied to one particular instance of cracking. The importance of creep ductility of high temperature materials is stressed. Author

**N88-14427#** Cambridge Univ. (England). Dept. of Materials Science and Metallurgy.
**THE EFFECT OF TEMPERATURE ON FATIGUE CRACK INITIATION FROM ALUMINOSILICATE INCLUSIONS**
P. Woollin and J. F. Knott *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 1087-1100 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Fatigue cracks were observed to initiate and grow from aluminosilicate inclusions in powder formed alloy AP-1 at stress intensities below the long crack threshold, both in air and under vacuum. Measured crack growth rates lie below previously reported short growth rate data for Astroloy under similar conditions. This is consistent with the presence of residual, tessellated stress fields associated with the inclusions. In vacuum, higher crack growth rates were observed at 600 C than at 20 C. Also, the transition from stage 1 to stage 2 crack growth occurs at lower applied delta kappa levels at 600 C than 20 C. These effects are related to the reduction of residual stresses with increasing temperature. Author

**N88-14428#** Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
**DEPENDENCE OF STRAINRANGE PARTITIONED FATIGUE LIFE AT ELEVATED TEMPERATURE ON MONOTONIC STRESS-STRAIN PROPERTIES**
A. Berkovits and S. Nadiv *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 1101-1112 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

On the basis of mechanical tests and metallographic studies, strainrange partitioning (SRP) lives are predicted by introducing stress-strain materials parameters into the Universal Slopes Equation. This was the result of correlation between fatigue damage mechanisms and deformation mechanisms operating at elevated temperatures. The parameters which must be evaluated for plasticity and creep life are the maximum stresses achievable under entirely plastic and creep conditions respectively, and corresponding inelastic strains, and the elastic modulus. For plasticity/creep interaction conditions, two more pairs of stress-strain parameters must be ascertained. The correlation between high temperature fatigue and stress-strain properties was satisfactory for nickel-base superalloys and stainless steel.
Author

**N88-14429#** Metz Univ. (France). Faculte des Sciences.
**THERMAL MECHANICAL LOW CYCLE FATIGUE OF 25CDV4-10 STEEL**
J. Gilgert, M. Lebienvenu, and G. Pluvinage *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 1113-1122 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Thermal mechanical fatigue behavior was investigated for constant amplitude, full reversed strain cycling of uniaxially loaded specimens at two ranges of temperature: 100 to 500 and 300 to 500 C with strain in phase with temperature. A model based on a relationship between thermal mechanical fatigue strain and low cycle fatigue strain is proposed and discussed. The material used in this program is a 25CDV4-10 steel that is representative of rotor materials used by present day large steam turbine generator manufacturers.
Author

**N88-14430#** Pennsylvania State Univ., University Park. Dept. of Engineering Science and Mechanics.
**AXIAL CREEP-FATIGUE DAMAGE ASSESSMENT IN TYPE 316 SS MATERIAL**
S. Y. Zamrik and D. C. Davis *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 1123-1132 Sponsored in part by the Welding Research Council, N.Y. (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Failure resulting from the interaction of creep-fatigue under a thirty minute hold time and in low cycle fatigue (LCF) at 620 C (1150 F) was assessed in terms of mechanical and microstructural response. Damage was analyzed by applying two strain ranges whereby the effect of plastic strain and creep strain was characterized. A strain rate concept is introduced for predicting creep-fatigue cumulative damage. The microstructural response to the interaction process was evaluated through fractographs.
Author

**N88-14431#** Institute of Aeronautical Materials, Beijing (China).
**AN ANALYSIS OF TEMPERATURE EFFECT ON LCF CRACK GROWTH RATES IN SUPERALLOY GH36**
Jizhou Xie and Shaolun Liu *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 1133-1142 (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

The low cycle fatigue crack growth rates of a superalloy GH36 was determined by the D. C. potential drop method in the temperature range 160 to 600 C. It was found that the high temperature growth rates of alloy GH36 can be characterized by stress intensity factor range delta kappa. The coefficient and exponent in Paris' formula are functions of temperature. An expression for Paris' formula of alloy GH36 over a wide range of temperature is proposed.
Author

**N88-14432#** Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
**THERMOMECHANICAL FATIGUE OF LEAD-BASE LOW TIN SOLDER**
L. R. Lawson, M. E. Fine, and D. A. Jeannotte (International Business Machines Corp., Hopewell Junction, N. Y.) *In* Virginia Univ., Fatigue 87, Volume 2 1987 p 1143-1151 Sponsored in part by IBM Corp. (For primary document see N88-14381 06-39)
Avail: NTIS HC A24/MF A01 CSCL 20K

Preliminary results of thermomechanical testing of a lead-base, low tin solder alloy are described. The effects of combined temperature and strain cycling are discussed. The effects of varying the relative timing and temperature of strain cycles are presented. Data are also reported for the effects of varying the strain range and hold time at maximum strain. Changes with yield stress during cycling are discussed and the effect of the relative phasing of the strain and temperature cycles is correlated with a phenomenological model.
Author

**N88-14433#** Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
**SUMMARY OF COMPARISON BETWEEN EXPERIMENTAL AND ANALYTICAL (INCLUDING EMPIRICAL) RESULTS FOR INITIATION OF CRACK GROWTH FOR SURFACE CRACKS**
W. G. Reuter 1986 49 p Presented at the 3rd National Symposium on Nonlinear Fracture Mechanics, New Orleans, La., 3 Nov. 1986
(Contract DE-AC07-76ID-01570)
(DE88-001604; EGG-M-26486; CONF-8611197-1) Avail: NTIS HC A03/MF A01

Surface-cracked specimens are used to simulate the behavior of structures containing defects. For these ferritic steel specimens the test temperatures of 255 and 297 K corresponded to the lower shelf and the lower region of the ductile-brittle transition curve, respectively. Therefore, the conditions tested ranged from elastic to elastic-plastic to fully plastic with only small changes in tensile properties but substantial changes in fracture toughness. This paper compares experimental results based on crack initiation for the surface-cracked specimens with predictions of J(sub Ic) and on an empirical correlation using the flow stress.
DOE

**N88-14434#** Los Alamos National Lab., N. Mex.
**THE MICROSTRUCTURE AND TEXTURE OF TORSION-REVERSE TORSION EXPERIMENTS**
A. D. Rollett, T. Lowe, U. F. Kocks, and M. G. Stout 1987 7 p Presented at the 8th International Conference on Textures of Materials, Santa Fe, N. Mex., 21 Sep. 1987 Prepared in cooperation with Sandia National Labs., Livermore, Calif.
(Contract W-7405-eng-36)
(DE88-001801; LA-UR-87-3618; CONF-8709172-1) Avail: NTIS HC A02/MF A01

Recent experiments with short thin-walled tubes (Lindholm design) tested in torsion and reverse torsion have confirmed both the persistence of a shear texture at zero net strain and the restoration of the grain shape. Calculations of theoretical texture development using a code based on the Bishop and Hill analysis have confirmed the reversibility of texture development when Taylor-based models are used. This code includes the effect or Relaxed Constraints and uses a nonlinear strain rate sensitivity to resolve the ambiguity of slip system choice. Calculations performed with the Asaro-Needleman code do leave a small residual texture at zero net strain. The conclusion is that there is sometimes an irreversible component of texture development that is not accounted for by the geometry of plastic deformation.
DOE

**N88-14435#** Mitsubishi Heavy-Industries Ltd., Tokyo (Japan).
**EVALUATION METHOD OF THE BRITTLE FRACTURE STRENGTH IN STRUCTURALLY STRESS-CONCENTRATED REGIONS**

K. Nigai, H. Yajima, and K. Kajimoto 1986 14 p
(PB87-129490; MTB-173) Avail: NTIS HC E03/MF E01 CSCL 20K

Various types of welded structures such as ships, off-shore structures and pressure vessels have their own unique stress-concentrated regions. Described is recent research into establishing adequate evaluation methods for brittle fracture strength in structurally stress-concentrated regions. To achieve this, structural specimens were designed as experimental models to represent the ends of stiffeners, since they appear in many welded structures and have often been the cause of brittle fracture. A series of tests and analyses were carried out on the experimental models using the elastoplastic fracture mechanics concept. GRA

**N88-14436#** Sydney Univ. (Australia). School of Civil and Mining Engineering.
**BEAM AND COLUMN BUCKLING UNDER DIRECTED LOADING**
N. L. Ings and N. S. Trahair Feb. 1986 31 p
(PB87-124004; R-516) Avail: NTIS HC E03/MF E01 CSCL 20K

Directed loading may have significant effects on the buckling resistances of beams and columns. Rotations of directed loads during buckling induce transverse components which may stabilize or destabilize the members. Previous studies of flexural-torsional buckling are limited to specific situations. Computer results show that the buckling resistances of beams and cantilevers under downwards loading are increased when the load direction points are below the load application points, and decreased when above. Members with top flange loads directed from above may have very low buckling resistance. GRA

**N88-14437#** Sydney Univ. (Australia). School of Civil and Mining Engineering.
**DISTORTIONAL BUCKLING FORMULAE FOR THIN-WALLED CHANNEL COLUMNS**
S. C. W. Lau and G. J. Hancock Mar. 1986 34 p
(PB87-124012; R-521) Avail: NTIS HC E03/MF E01 CSCL 20K

Explicit analytical expressions are derived to predict the distortional buckling stress of thin-walled channel section columns with a range of section geometries, including column types used for industrial storage racks. The analytical expressions are based on an approximate model of the distortional buckling mode. GRA

**N88-14438#** Cambridge Univ. (England). Dept. of Engineering.
**COMPARISON OF THE STRENGTH OF SINGLE AND MULTIPLE BOLTED JOINTS IN CFRP**
P. A. Smith, K. J. Pascoe, N. Lee, and T. R. Mairs Mar. 1986 36 p
(PB87-123766; CUED/C-MATS/TR-124) Avail: NTIS HC E05/MF E05 CSCL 20K

Experimental data are presented for the strengths of single hole and two hole double lap bolted joints in a particular carbon fiber reinforced plastic layup. The failure modes are described and the application of simple failure criteria is investigated. Author

**N88-14439*#** Cambridge Univ. (England). Dept. of Engineering.
**ANALYSIS OF CRACK CLOSURE UNDER PLANE STRAIN CONDITIONS**
N. A. Fleck and J. C. Newman May 1986 42 p Sponsored by NASA
(NASA-CR-182389; NAS 1.26:182389; PB87-122966; CUED/C-MATS/TR-127) Avail: NTIS HC E05/MF E05 CSCL 20K

The phenomenon of plasticity-induced crack closure is associated with the development of residual material on the flanks of an advancing fatigue crack. While it is easy to see that this residual material can come from the side faces of a specimen under plane stress conditions, it is difficult to discover the origin of this extra volume of material on the crack flanks when it is assumed that plane deformations occur and plastic flow is incompressible. The purpose of this paper is to determine whether plasticity-induced fatigue crack closure occurs in an elastic-perfectly plastic body under plane strain conditions. GRA

**N88-14440** Alabama Univ., University.
**GEOMETRICALLY NONLINEAR ANALYSIS OF STIFFENED PANELS Ph.D. Thesis**
Daniel Duke [1987] 104 p
Avail: Univ. Microfilms Order No. DA8720684

The purpose was to develop a solution method whereby displacements, loads, and stresses could to determined for a rectangular stiffened panel subjected to both pressure and thermal loading. An updated Lagrangian formulation of the finite element method is used. The geometrically nonlinear nature of the problem is handled using a scheme consisting of load incrementation with nodal equilibrium iteration. A special link element is developed to model the skip welded interface between the plate and the stiffener. The method was checked using a classically geometrically nonlinear plate problem. The results are in good agreement with the classical solution. Dissert. Abstr.

**N88-14441*#** National Aeronautics and Space Administration, Washington, D.C.
**A LOADING SYSTEM FOR CREEP TESTING UNDER CONSTANT COMPRESSIVE STRESS**
F. Dobes, O. Zverina, and J. Cadek Oct. 1987 18 p Transl. into ENGLISH from Kovove Materialy (Czechoslovakia), v. 24, no. 5, 1986 p 599-610 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3541)
(NASA-TT-20119; NAS 1.77:20119; ISSN-0023-432X) Avail: NTIS HC A03/MF A01 CSCL 20K

A critical analysis is made of layouts assuring constant stress under creep, pointing out the difficulties of using these layouts for compressive testing. A new mechanical system to maintain stress during creep testing is proposed. Constant stress is achieved by a definite motion of the load. The proposed system can be used in tensile or compressive testing. Practical measurements reveal that the stress constancy error is not greater than plus or minus 1.5 percent up to relative deformation of 30 percent. Author

**N88-14442#** Societe Nationale Industrielle Aerospatiale, Suresnes (France). Direction Centrale de la Qualite.
**STUDY OF THE EVOLUTION OF SHORT CRACKS IN FATIGUE ANALYSIS [ETUDE DE L'EVOLUTION DES FISSURES COURTES EN FATIGUE]**
A. LeFrancois, G. Pons, D. Aliaga, A. Pineau, and R. Labourdette 15 Jan. 1987 220 p In FRENCH
(Contract DRET-83-34-323)
(DCQ/L-46-555; ETN-88-90651) Avail: NTIS HC A10/MF A01

Thin plate fatigue is studied considering the joint effects of load spectra and ellipsoidal crack fronts. The fatigue study is carried out using the 2124 T 351 and the 7475 T 7351 aluminum alloys. The results show a short crack effect on the 7475 under constant amplitude loading and on the 2124 for the case of overloading. The mechanisms are discussed, suggesting that the differences are explained by different closing mechanisms, plasticity in one case and microstructure in the other. ESA

**N88-14443#** Helsinki Univ. of Technology, Espoo (Finland).
**BOUNDARY ELEMENT ANALYSIS FOR DYNAMIC LOADING OF A CIRCULAR PLATE ON AN ELASTIC MEDIUM Ph.D. Thesis**
Jari Puttonen 1987 92 p Sponsored by the Imatran Voima Oy, Helsinki, Finland
(Ci-86; ISBN-951-666-241-2; ISSN-0355-2705; ETN-88-90734)
Avail: NTIS HC A05/MF A01

The behavior of a circular plate on an elastic medium and the applicability of the boundary element method to solving the problem were studied. The loading can be dynamic or static. The dynamic problem was solved in the frequency domain by the Fourier transform technique. Equations based on the direct and indirect boundary element methods were derived for a plate on a one or

two-parameter elastic medium. Computer programs based on the direct and indirect boundary element methods were developed. Examples presented relate to the behavior of the foundation plate of a nuclear power plant. The study shows that the boundary element method is applicable to the static and dynamic analysis of a plate on an elastic medium. ESA

**N88-14444#** Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
**PARTIALLY BRACED INELASTIC BEAM BUCKLING EXPERIMENTS**
A. D. Wong-Chung and S. Kitipornchai Jun. 1986 38 p
(PB87-133831; RR-CE72) Avail: NTIS HC E03/MF E01 CSCL 20K

An experimental study of the inelastic buckling behavior of partially braced I-beams is described. Eleven rolled 250UB37 steel beams, of lengths 7, 9 and 11.2 meters, each having different types of intermediate partial bracing, were tested. A specially designed bracing box provided either rotational bracing or lateral bracing to the beam cross-section at mid-span. Measurements of initial geometrical imperfections and residual stresses of the test beams were made. Experimental results obtained are in good agreement with the theoretical predictions from a geometrical and material non-linear finite element analysis. The results confirmed that a lateral brace placed at the tension flange is virtually ineffective, while a rotational brace or a lateral brace placed at the shear center is fully effective. It was found that design loads predicted by the BS5950 and the AISC specifications provided good lower bound estimates to the failure loads of the test beams. GRA

**N88-14445#** Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
**BUCKLING OF BRACED MONOSYMMETRIC CANTILEVERS: TIMOSHENKO ENERGY APPROACH**
S. Kitipornchai, C. M. Wang, and V. Thevendran Aug. 1986 37 p
(PB87-133849; RR-CE74) Avail: NTIS HC E03/MF E01 CSCL 20K

The paper examines the elastic lateral buckling of monosymmetric cantilevers with a discrete intermediate brace. On the basis of the Timoshenko energy approach, the buckling capacities are determined by direct minimization of the Rayleigh quotient. The influences of lateral brace at different levels, of rotational brace and of full brace at different levels on the buckling capacities for varying brace locations, height of load application above the shear center, and the degree of beam monosymmetry are investigated. GRA

**N88-14446#** Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
**GEOMETRIC NONLINEAR ANALYSIS OF ASYMMETRIC THIN-WALLED MEMBERS**
S. L. Chan and S. Kitipornchai Jul. 1986 61 p
(PB87-133856; RR-CE73) Avail: NTIS HC E04/MF E01 CSCL 20K

The geometric nonlinear large deflection analysis of structures comprising members of asymmetric thin-walled open section is investigated. The geometric stiffness matrix for a thin-walled element is derived, incorporating second order nonlinear strain terms in the governing energy equation. The derived stiffness matrices are used to predict bifurcation loads of a number of structures. An updated Lagrangian formulation, coupled with the numerical arc-length technique, is employed to trace the nonlinear pre-buckling and post-buckling load-deflection paths. Numerical examples of the large deflection behavior of a hexagonal frame and of eccentrically loaded and restrained unequal angle beam-columns are presented. GRA

**N88-14447*#** AiResearch Mfg. Co., Torrance, Calif.
**ADVANCED FABRICATION TECHNIQUES FOR HYDROGEN-COOLED ENGINE STRUCTURES Final Report, Oct. 1975 - Jun. 1982**
O. A. Buchmann, V. V. Arefian, H. A. Warren, A. A. Vuigner, and M. J. Pohlman Nov. 1985 123 p
(Contract NAS1-14180)
(NASA-CR-3949; NAS 1.26:3949; AMC-81-17928) Avail: NTIS HC A06/MF A01 CSCL 20K

Described is a program for development of coolant passage geometries, material systems, and joining processes that will produce long-life hydrogen-cooled structures for scramjet applications. Tests were performed to establish basic material properties, and samples constructed and evaluated to substantiate fabrication processes and inspection techniques. Results of the study show that the basic goal of increasing the life of hydrogen-cooled structures two orders of magnitude relative to that of the Hypersonic Research Engine can be reached with available means. Estimated life is 19000 cycles for the channels and 16000 cycles for pin-fin coolant passage configurations using Nickel 201. Additional research is required to establish the fatigue characteristics of dissimilar-metal coolant passages (Nickel 201/Inconel 718) and to investigate the embrittling effects of the hydrogen coolant. Author

**N88-14448#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
**STEADY WAVES IN A NONLINEAR THEORY OF VISCOELASTICITY Ph.D. Thesis**
Gregory T. Warhola 1987 136 p
(AD-A185548; AFIT/CI/NR-87-78T) Avail: NTIS HC A07/MF A01 CSCL 20K

This work considers the propagation of steady waves in viscoelastic material for which the nonlinear strain measure is not necessarily convex. The shape of such a wave is governed by an ordinary nonlinear integro-differential equation having a possibly singular difference kernel. The existence and structure of a solution depends upon the relation of the wavespeed, a parameter in the problem, to two speeds based upon the state of the material ahead of the wave. Solutions are constructed by a monotone iterative scheme which is proven to converge to a unique solution within restricted classes of functions depending upon the wavespeed. A simple numerical approximation to the iterative scheme is used to produce graphs of solutions. An algebraic quasielastic approximation produces upper bounds on discontinuous ( shock and acceleration wave) solutions. For a material such as polymethyl methacrylate (PMMA) having a small power in a power-law model of its compliance, this approximation is found to be useful for accurately predicting the structure of shock solutions. GRA

**N88-14449#** Maryland Univ., College Park.
**STABILITY ANALYSIS OF A RIGID BODY WITH A FLEXIBLE ATTACHMENT USING THE ENERGY-CASIMIR METHOD**
Thomas A. Posbergh, P. S. Krishnaprasad, and Jerrold E. Marsden 1987 22 p
(Grants AF-AFOSR-0073-87; NSF OIR-85-00108)
(AD-A185846; AFOSR-87-1385TR) Avail: NTIS HC A03/MF A01 CSCL 20K

A system is considered consisting of a rigid body to which a linear extensible shear beam is attached, For such a system the Energy-Casimir method can be used to investigate the stability of the equilibria. In this case, it can be shown that a test for (formal) stability reduces to checking the positive definiteness of two matrices which depend on the parameters of the system and the particular equilibrium about which the stability is to be ascertained. Author (GRA)

**N88-14450#** Centre de Recherches de l'Inst. Superieur Industriel Catholique du Hainaut (Belgium).
**STRESSES AND DISPLACEMENTS IN TWO, THREE AND FOUR LAYERED STRUCTURES SUBMITTED TO FLEXIBLE OR RIGID LOADS Final Report, Sep. 1986 - Sep. 1987**
F. VanCauwelaert, F. Delaunois, and L. Beaudoint 30 Sep. 1987 180 p
(Contract DAJA45-86-M-0483; DA Proj. 1L1-61102-BH-57)

(AD-A185707; R/D-5441-EN-01) Avail: NTIS HC A09/MF A01 CSCL 20K

A computer program written in FORTRAN 77 and recorded on diskettes compatible with an IBM PC computer was run efficiently. A Handbook was written containing: all expressions of stress, strains and displacements in close form with an analysis of the manner how they were obtained and all the required theoretical references; a complete layout of program; a printed list of program; and an instruction list for its utilization. GRA

**N88-14451#** California Univ., Berkeley. Computer Systems Research Group.

**AN EMPIRICAL INVESTIGATION OF LOAD INDICES FOR LOAD BALANCING APPLICATIONS Technical Report, 7 Aug. 1984 - 6 Aug. 1987**

Domenico Ferrari and Songnian Zhou Jul. 1987 10 p
(Contract N00039-84-C-0089; ARPA Order 4871)
(AD-A185763) Avail: NTIS HC A02/MF A01 CSCL 20K

This paper empirically evaluates the quality of several load indices in the context of dynamic load balancing. The authors have implemented a load balancer for Sun/UNIX environments. In their experimental setup, six Sun-2 workstations were driven by job scripts, and job response times were measured while loads were being balanced and various load indices used to make job placement decisions. Studied are the effects on performance of the choice of load index, the averaging interval, the load information exchange period, and the characteristics of the workload. Measurements show that the performance benefits of load balancing are indeed strongly dependent upon the load index. Load indices based on resource queue lengths are found to perform better than those based on resource utilization, and the use of an exponential smoothing method yields further improvement over that of instantaneous queue lengths. Author (GRA)

**N88-14452#** North Carolina State Univ., Raleigh.

**FAST ALGORITHMS FOR STRUCTURAL OPTIMIZATION AND LEAST SQUARES Annual Interim Report, 15 Jul. 1986 - 14 Jul. 1987**

Robert J. Plemmons 7 Aug. 1987 11 p
(Contracts AF-AFOSR-83-0255; AF Proj. 2304)
(AD-A185766; AFOSR-87-1407TR) Avail: NTIS HC A03/MF A01 CSCL 12A

This report summarizes the activities in support of the Air Force Research Project AFOSR-83-0255 during the past year. Efforts have been made to develop, test and analyze new fast techniques in matrix analysis for structural computations and least squares problems. Applications of this work include structural design and dynamics, and least squares filtering in signal processing. Implementations and tests have been made on modern high performance architectures such as the Cray X-MP, Alliant FX/8, Sequent Balance and the Intel iPSC Hypercube. Our recent work on parallel algorithms for near real-time signal processing computations has led to especially significant results.
Author (GRA)

**N88-14453*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**FATIGUE LIFE PREDICTION MODELING FOR TURBINE HOT SECTION MATERIALS**

G. R. Halford, T. G. Meyer, R. S. Nelson, D. M. Nissley, and G. A. Swanson (United Technologies Research Center, East Hartford, Conn.) [1988] 17 p Prepared for presentation at the 33rd International Gas Turbine and Aeroengine Congress and Exposition, Amsterdam, The Netherlands, 5-9 Jun. 1988; sponsored in part by American Society of Mechanical Engineers
(NASA-TM-100291; E-3927; NAS 1.15:100291) Avail: NTIS HC A03/MF A01 CSCL 20K

A major objective of the fatigue and fracture efforts under the Hot Section Technology (HOST) program was to significantly improve the analytic life prediction tools used by the aeronautical gas turbine engine industry. This was achieved in the areas of high-temperature thermal and mechanical fatigue of bare and coated high-temperature superalloys. The cyclic crack initiation and propagation resistance of nominally isotropic polycrystalline and highly anisotropic single crystal alloys were addressed. Life prediction modeling efforts were devoted to creep-fatigue interaction, oxidation, coatings interactions, multiaxiality of stress-strain states, mean stress effects, cumulative damage, and thermomechanical fatigue. The fatigue crack initiation life models developed to date include the Cyclic Damage Accumulation (CDA) and the Total Strain Version of Strainrange Partitioning (TS-SRP) for nominally isotropic materials, and the Tensile Hysteretic Energy Model for anisotropic superalloys. A fatigue model is being developed based upon the concepts of Path-Independent Integrals (PII) for describing cyclic crack growth under complex nonlinear response at the crack tip due to thermomechanical loading conditions. A micromechanistic oxidation crack extension model was derived. The models are described and discussed. Author

**N88-14454#** Georgia Inst. of Tech., Atlanta. Fracture and Fatigue Research Lab.

**TRANSIENTS IN ELEVATED TEMPERATURE CRACK GROWTH**

A. Saxena and B. Gieseke May 1987 20 p Presented at the International Seminar on High Temperature Fracture Mechanisms and Mechanics, Dourdan, France, 13 Oct. 1987
(Contract DE-FG05-86ER-45257)
(DE87-013189; DOE/ER-45257/2; CONF-8710123-1) Avail: NTIS HC A03/MF A01

Transients which affect the crack growth behavior of metals at elevated temperature under cyclic and static loading are classified as (1) deformation transients which are present due to the relaxing crack tip stress fields during small scale creep and (2) damage or crack growth transients which are present during the period in which a steady-state damage state evolves at the crack tip starting from an initially undamaged state. It is shown using extensive amounts of creep and creep-fatigue crack growth data on 1CR-1Mo-0.25V steel that deforation transients under static as well as cyclic loading are completely normalized by the C/sub t/ parameter. It is also shown that the other crack tip parameters such as K, C*, and C(t) are unable to normalize the influence of deformation transients. However, C/sub t/ fails to uniquely characterize the crack growth rate during the damage or crack growth transient. DOE

**N88-14866*#** Texas A&M Univ., College Station. Dept. of Mechanical Engineering.

**ACTIVE CONTROL OF FLEXURAL VIBRATIONS IN BEAMS Final Report**

Carl H. Gerhold *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 20 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 20K

**N88-14881*#** Arizona Univ., Tucson. Dept. of Aerospace and Mechanical Engineering.

**RANDOM LOADING FATIGUE CRACK GROWTH: CRACK CLOSURE CONSIDERATIONS Final Report**

Keith Ortiz *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 21 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 21 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 20K

**N88-14891*#** Prairie View Agricultural and Mechanical Coll., Tex. Dept. of Civil Engineering.

**FRACTURE STUDY OF WINDSHIELD GLASS PANES Final Report**

H. Y. Yeh *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov.

1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 20 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 20K

# 42 GEOSCIENCES (GENERAL)

**N88-14455#** Joint Publications Research Service, Arlington, Va.
**USSR REPORT: EARTH SCIENCES**
22 May 1987 123 p Transl. into ENGLISH from various Russian articles
(JPRS-UES-87-004) Avail: NTIS HC A06/MF A01

Earth science research in the U.S.S.R is reported. Meteorology, oceanography, atmospheric physics, and arctic and antarctic research are discussed. For individual titles, see N88-14456 through N88-14481.

**N88-14456#** Joint Publications Research Service, Arlington, Va.
**AN-30M CLOUD-SEEDING AIRPLANE IN INTERNATIONAL EXHIBITION Abstract Only** **c47**
A. Pyrkov *In its* USSR Report: Earth Sciences 22 May 1987 p 2 Transl. into ENGLISH from Vozdushnyy Transport (Moscow, USSR), 6 Dec. 1986 p 4 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

The capabilities of the AN-30M aircraft intended for weather modification flights are noted. It is claimed that this new aircraft is very effective. The airplane was also tested in agricultural applications, and it has been used to purify the air over industrial enterprises. R.J.F.

**N88-14457#** Joint Publications Research Service, Arlington, Va.
**REGIONAL WEATHER SATELLITE DATA PROCESSING CENTER OPENS IN TASHKENT Abstract Only** **c47**
V. Artemenko and Yu. Chernogayev *In its* USSR Report: Earth Sciences 22 May 1987 p 3 Transl. into ENGLISH from Pravda (Moscow, USSR), 7 Jan. 1987 p 6 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

A regional center for receiving and processing data from satellites was created at Tashkent. Meteorological information from Meteor satellites is processed and widely used for weather forecasting. Photographs are received there four time a day, making it possible to keep track of the dynamic development of atmospheric processes. The pictures are sent to an analytical laboratory, where specialists overlay them with a meridian grid to prepare weather maps. Copies of the maps are sent to 15 countries. The Tashkent center receives information on the weather from an area from the Indian Ocean to the Arctic Circle, and from Central Europe to Siberia. Author

**N88-14458#** Joint Publications Research Service, Arlington, Va.
**BARS-1M METEOROLOGICAL COMPLEX CARRIED ON IL-18 AIRPLANE Abstract Only** **c47**
Aleksandr Ruvinskiy *In its* USSR Report: Earth Sciences 22 May 1987 p 4-5 Transl. into ENGLISH from Leninskoye Znamya (Leningrad, USSR), 24 Nov. 1986 p 4 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

An account is given of the use of the BARS-1M, a computerized meteorological complex, in measuring and analyzing meteorological and navigational information relative to a front of nimbus clouds approaching the Chernobyl area after the accident there. The airborne instruments are capable of monitoring wind movement characteristics, pressure, temperature and humidity. In this incident, BARS correctly determined the wind field and provided information on the path that the rain clouds were following. R.J.F.

**N88-14459#** Joint Publications Research Service, Arlington, Va.
**CURRENT STATUS OF WORLD WEATHER SERVICE Abstract Only** **c47**
L. S. Dubrovina *In its* USSR Report: Earth Sciences 22 May 1987 p 7 Transl. into ENGLISH of Gidrometeorologiya: Seriya Meteorologiya, Sovremennoye Sostoyaniya Vsemirnoy Sluzhby Pogody (Obninsk, USSR), no. 7, 1986 p 1-36 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

The general structure of the World Weather Service and the United Nations Environmental Program are briefly discussed and progress made over the past decade in the automation of weather observation is noted. The current status of the World Weather Service, the major program of the World Meteorological Organization, is described, emphasizing the need for international cooperation among meteorologists. Author

**N88-14460#** Joint Publications Research Service, Arlington, Va.
**NEW METHOD OF ESTIMATING CONTINENTALITY OF CLIMATE ON GLOBAL SCALE Abstract Only** **c47**
B. V. Poltaraus *In its* USSR Report: Earth Sciences 22 May 1987 p 8 Transl. into ENGLISH from Vestnik Moskovskogo Universiteta, Seriya 5: Geografiya (Moscow, USSR), no. 1, Jan. - Feb. 1986 p 64-72 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

Two equations are derived for estimating the continentality of climate. An improvement of one of these equations to allow determination of the continentality of climate for the entire earth is is suggested. The improvement suggested is based on the idea of purely oceanic and purely continental influences. The final equation, considering the daily amplitude of air temperature, relative humidity and amplitude of variations in dew point, was used to calculate continentality for a number of points in different climatic zones with different types of climates. It was found to be quite sensitive and universal, applicable to a wide variety of climate types and zones, providing a quantitative characteristic of climate, the degree of participation of continental influences and their origin. Author

**N88-14461#** Joint Publications Research Service, Arlington, Va.
**USES OF AIRBORNE LASER CHAYKA-1 FOR PROBING WATER, LAND SURFACES Abstract Only** **c43**
V. Lagovskiy *In its* USSR Report: Earth Sciences 22 May 1987 p 24-25 Transl. into ENGLISH from Sotsialisticheskaya Industriya (Moscow, USSR), 11 Dec. 1986 p 4 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

Applications of the first airborne laser unit, Chayka-1 are discussed. The unit is reportedly installed on an AN-30 airplane marked with the number 30060. Tests of the laser to reveal an infection of cotton plants in the Fergana Valley were undertaken. An infection was revealed in its early stages, and the height of the plants was determined. It is claimed that the laser unit can be used not only to determine the composition of impurities in water, but also their composition. With oil, it is claimed that the laser unit can tell the type of oil and also whether it was spilled by a passing tanker or seeped from a nearby offshore well. R.J.F.

**N88-14462#** Joint Publications Research Service, Arlington, Va.
**TECTONICS OF THE CAROLINE OCEANIC STEP (SOUTHWESTERN PACIFIC OCEAN) Abstract Only** **c48**
Yu. M. Pushcharovskiy and Yu. N. Raznitsin *In its* USSR Report: Earth Sciences 22 May 1987 p 28 Transl. into ENGLISH from Geotektonika (Moscow, USSR), no. 6, Nov. - Dec. 1986 p 40-54 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

A discussion of the Southwestern Pacific, which the authors call the Caroline Oceanic Step, is presented. The tectonics and history of the development of the region are described. The step, located between the Caroline Islands on the north and the Melanesian island arc trenches to the south, was formed by subsidence of the Eastern Marianas Abyssal Plate in the Late Eocene and Early Oligocene. The structure and material composition of Mussau Ridge are discussed on the basis of data

collected during the ninth cruise of the research vessel Akademik Mstislav Keldysh. Author

**N88-14463#** Joint Publications Research Service, Arlington, Va.
**TECTONICS AND MAGMATISM OF WALVIS RIDGE AND DISCOVERY RISE (ATLANTIC OCEAN) Abstract Only c48**
B. P. Zolotarev and B. N. Kotenev *In its* USSR Report: Earth Sciences 22 May 1987 p 28-29 Transl. into ENGLISH from Geotektonika (Moscow, USSR), no. 6, Nov. - Dec. 1986 p 55-68 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

A detailed study is presented of two structures: Walvis Ridge and Discovery Rise. The discussion is based on additional data collected on the relief of these upthrusts in 1979 to 1980 aboard the research vessel, Professor Mesyatsev. Rock specimens dredged from the area were studied. Published materials from previous studies of the geological structure and geophysics of the ridge and the composition of the volcanic rock in the area are also considered. Both structures have a typical oceanic crust with a thickness of 20 to 25 or 30 km. Subalkaline and alkaline rocks are predominant in the geological structure. Mantle hot spots have altered the geological structure of the upthrusts. Author

**N88-14464#** Joint Publications Research Service, Arlington, Va.
**CONCENTRATION COEFFICIENTS OF ELEMENTS IN FERROMANGANESE NODULES RELATIVE TO OCEAN SEDIMENTS Abstract Only c48**
G. N. Baturin *In its* USSR Report: Earth Sciences 22 May 1987 p 29-30 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 291, no. 2, Nov. 1986 p 451-453 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

A first attempt is made to present the full picture of the accumulation of elements in abyssal ferromanganese nodules relative to ocean sediments based on original data and data from the literature obtained mostly in the past 5 to 6 years. Manganese in the nodules is associated with Ni, Cu, Zn, Mo, Cd, and Tl whereas iron is associated with Co, V, P, Pb, Zr, Ta, Nb, Sb, As, Bi, U and Th. Author

**N88-14465#** Joint Publications Research Service, Arlington, Va.
**STATISTICAL STRUCTURE OF TEMPERATURE FIELD OVER SOUTH PACIFIC OCEAN Abstract Only c48**
V. A. Vasilyev, L. V. Vasilyeva, and A. V. Kondratyev *In its* USSR Report: Earth Sciences 22 May 1987 p 30 Transl. into ENGLISH from Vestnik Leningradskogo Universiteta, Seriya 7: Geologiya, Geografiya (Leningrad, USSR), no. 4, Dec. 1986 p 106-109 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

An attempt is made, using the South Pacific ocean as an example, to study the vertical statistical structure of the January temperature field based on daily satellite radiometer soundings of the atmosphere over a period of five years for 15 isobar surfaces over the Pacific. The behavior of the calculated quantitative characteristics is studied in several latitude zones. It is found that in an area with a sparse network of aerologic stations, such as the South Pacific, the statistical structure of the temperature field can be analyzed using satellite radiometric sounding data. The quantitative and qualitative agreement of the data from such aerologic stations and satellites is good. Author

**N88-14466#** Joint Publications Research Service, Arlington, Va.
**GEOPHYSICAL-GEOMORPHOLOGICAL STATISTICAL REGIONALIZATION OF NORTH ATLANTIC Abstract Only c48**
V. S. Mironov and V. G. Mishenkov *In its* USSR Report: Earth Sciences 22 May 1987 p 30 Transl. into ENGLISH from Vestnik Leningradskogo Universiteta, Seriya 7: Geologiya, Geografiya (Leningrad, USSR), no. 4, Dec. 1986 p 93-97 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

A study was made of a statistical method used as a basis for establishing mutual correlation among measured ocean depths and gravity anomalies. The relationships are used to regionalize the North Atlantic Ocean. The method is implemented as a computer program written in PL-1. The results are presented without analysis of the geological factors governing the regionalization of the area. Author

**N88-14467#** Joint Publications Research Service, Arlington, Va.
**INFLUENCE OF GAS EXCHANGE BETWEEN OCEAN AND ATMOSPHERE ON FORMATION OF ATMOSPHERIC PRESSURE FIELD Abstract Only c46**
I. P. Semiletov *In its* USSR Report: Earth Sciences 22 May 1987 p 32 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 291, no. 5, Dec. 1986 p 1231-1234 Original language document was announced in IAA as A87-29793 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

The mechanisms of gas exchange in the ocean-atmosphere system and the possible effects on the formation of an atmospheric pressure field are examined with reference to observation data. It is shown that in regions of intense vertical water exchange, which may affect the formation of atmospheric action centers by creating certain local and regional conditions, it is important that gas exchange in the ocean-atmosphere system be taken into account along with the energy exchange in the form of heat and moisture. Author

**N88-14468#** Joint Publications Research Service, Arlington, Va.
**TECTONICS OF SEDIMENTARY COVER AND BASEMENT OF LABRADOR SEA Abstract Only c48**
K. A. Klitin *In its* USSR Report: Earth Sciences 22 May 1987 p 33 Transl. into ENGLISH from Byulleten Moskovskogo Obshchestva Ispytateley Prirody: Otdel Geologicheskiy (Moscow, USSR), v. 62, no. 1, Jan. - Feb. 1987 p 25-36 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

Data obtained by drilling are used to describe the cross section of sedimentary cover in the Labrador Sea between Labrador and Greenland. The acoustic basement and its surface structure are described. The consolidated oceanic crust in the area was created before the beginning of the formation of the present sedimentary cover by spreading or by physical and mineralogical processes leading to thinning and transformation of the continental crust to an oceanic crust and the appearance of plateau basalts. The rift valley of the central Labrador upthrust probably developed in connection with relatively recent spreading. The Newfoundland oceanic basin was laid down simultaneously with the process of formation of the oceanic crust. The Labrador deep-water basin was almost completely filled with sediment by the Late Miocene. Sediment occurred here under shallow conditions during the Pliocene. During the Quaternary, new down-warping occurred, creating the present day deep water trench of the Labrador Sea and the surrounding continental and island slopes. Author

**N88-14469#** Joint Publications Research Service, Arlington, Va.
**MATHEMATICAL-CARTOGRAPHIC MODELING OF ECONOMIC UTILIZATION OF ATLANTIC OCEAN Abstract Only c48**
Ye. A. Sigolayeva and V. S. Tikunov *In its* USSR Report: Earth Sciences 22 May 1987 p 36 Transl. into ENGLISH from Geografiya i Prirodnyye Resursy (Novosibirsk, USSR), no. 4, Oct. - Dec. 1986 p 113-121 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

An economic regionalization of the Atlantic Ocean is attempted, based on published data on the economic utilization of the ocean. The economic utilization of a water area is determined by coastal population, location of production facilities and ports, degree of utilization of mineral and power resources, intensity of fishing, and marine transport. Maps showing accessibility of an area to coastal populations, distribution of biomass in the ocean, density of shipping, level of pollution by oil film, and the locations of oil and gas bearing basins are given. Author

**N88-14470#** Joint Publications Research Service, Arlington, Va.
**TWO-LAYER MODEL OF CIRCULATION IN WORLD OCEAN WITH DETAILED DESCRIPTION OF SEASONAL EVOLUTION OF UPPER QUASIHOMOGENEOUS LAYER Abstract Only** **c48**
B. A. Kagan, V. A. Ryabchenko, and S. A. Fokin *In its* USSR Report: Earth Sciences 22 May 1987 p 38 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 291, no. 3, Nov. 1986 p 699-703 Original language document was announced in IAA as A87-29041 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

A two-layer model of circulation in the world ocean is outlined. The ocean is divided into two layers, the upper quasihomogeneous layer (UQL) and deep layer, in each of which the temperature is assumed to be invariable in depth and subject to determinination, together with the vertically averaged velocity component, level disturbance and thickness of the UQL and deep layer. The pertinent equations for the model are derived under these and other simplifying assumptions. Examples of computations are given.
Author

**N88-14471#** Joint Publications Research Service, Arlington, Va.
**REMOTE ACOUSTIC SOUNDING OF FERROMANGANESE NODULES Abstract Only** **c48**
Yu. Yu. Zhitkovskiy, A. Yu. Zakhlestin, A. I. Zotov, V. I. Kayevitser, G. M. Petrov, and A. V. Sknarya *In its* USSR Report: Earth Sciences 22 May 1987 p 39 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 291, no. 3, Nov. 1986 p 697-699 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

The characteristics of sound scattering in the abyssal ocean regions of Fe-Mn nodule concentrations in the Pacific Ocean were studied in the summer of 1983. The objective was the determination of the possibilities of using remote acoustic methods in the exploration of Fe-Mn deposits. A side-looking sonar and a unit for shaping and preprocessing linear frequency-modulated signals were used. It was found that all stations with a high concentration of nodules (more than 15 kg per square meter) correspond to zones of strong scattering; stations with a density of less than 10 kg per square meter correspond to zones of moderate scattering, etc. The remote sounding backscattered signal provides data on several parameters of use in characterizing the Fe-Mn deposits: density, size distribution of nodules, percent of the floor covered by the nodules, and the distance between individual nodules. Author

**N88-14472#** Joint Publications Research Service, Arlington, Va.
**FERROMANGANESE NODULES OF ANTARCTIC SECTOR IN PACIFIC OCEAN Abstract Only** **c48**
G. N. Baturin, V. N. Lukashin, and A. Ya. Shevchenko *In its* USSR Report: Earth Sciences 22 May 1987 p 45 Transl. into ENGLISH from Tikhookeanskaya Geologiya (Novosibirsk, USSR), no. 5, Sep. - Oct. 1986 p 23-28 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

The Antarctic sector of the Pacific Ocean is one of the regions of massive occurrence of Fe-Mn nodules. A study of these nodules was made using material from the 30th cruise of the Dmitriy Mendeleyev (November 1982 to March 1983). The samples were dredged from the floor on the meridional run across the southwestern part of the Antarctic Basin. The productivity of the nodules was 8 to 15 kg per square meter. They had a diameter of 3 to 6 cm. The structure of the ore matter was studied using a scanning microscope. Chemical composition was determined by the atomic absorption method. A table gives the chemical compositions (18 elements) in comparison with the corresponding averages for the world ocean. Author

**N88-14473#** Joint Publications Research Service, Arlington, Va.
**STUDY OF EVOLUTION OF GULF STREAM CYCLINIC EDDY Abstract Only** **c48**
V. A. Bubnov, A. B. Zubin, L. V. Moskalenko, and A. S. Osadchiy *In its* USSR Report: Earth Sciences 22 May 1987 p 48 Transl. into ENGLISH from Okeanologiya (Moscow, USSR), v. 26, no. 5, Sep. - Oct. 1986 p 732-737 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

Three hydrological surveys carried out from January to March 1984 in the Gulf Stream are reviewed. In general, after some weakening between the first and second surveys, during the third survey the cyclonic eddy intensified. The two-core cyclonic movement had split into two daughter eddies and had entered into contact with the Gulf Stream, at the same time turning clockwise by almost 90 degrees. The larger of the eddies, after this contact, departed from the Gulf Stream, whereas the smaller merged with it, forming a meander. Author

**N88-14474#** Joint Publications Research Service, Arlington, Va.
**ROLE OF ANOMALOUS CURRENTS IN FORMATION OF OCEAN SURFACE TEMPERATURE FIELD Abstract Only** **c48**
L. I. Piterbarg *In its* USSR Report: Earth Sciences 22 May 1987 p 48-49 Transl. into ENGLISH from Okeanologiya (Moscow, USSR), v. 26, no. 5, Sep. - Oct. 1986 p 738-742 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

A number of earlier studies have provided evidence of the presence of a cause and effect relationship between the formation and evolution of anomalies of ocean surface temperature and anomalies of the character of drift currents. Here, a theoretical approach to the study of the mechanisms of the effect of anomalous currents on the field of ocean surface temperature as a whole and its annual variation and anomalies, is given on the basis of rigorously derived equations for the statistical moments of the temperature field in a randomly inhomogeneous medium.
Author

**N88-14475#** Joint Publications Research Service, Arlington, Va.
**ERRORS IN RETRIEVING HYDROLOGICAL FIELDS AND FIELDS OF THEIR DIFFERENTIAL CHARACTERISTICS BY METHOD OF APPROXIMATION BY ORTHOGONAL FUNCTIONS Abstract Only** **c48**
O. P. Nikitin and Yu. Ya. Elken *In its* USSR Report: Earth Sciences 22 May 1987 p 49-50 Transl. into ENGLISH from Okeanologiya (Moscow, USSR), v. 26, no. 5, Sep. - Oct. 1986 p 743-750 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

It is proposed that the problem of positioning measurement points for retrieving two-dimensional hydro- and meteorological fields and the fields of their differential characteristics be solved within the framework of a method involving approximation by orthogonal functions, as proposed by C. E. Wallington. An in-depth discussion of this method for retrieving the two-dimensional fields of a sought for scalar parameter and its linear differential characteristics is presented. Author

**N88-14476#** Joint Publications Research Service, Arlington, Va.
**HYDROCHEMICAL STRUCTURE OF GULF STREAM FRONTAL ZONE WATERS Abstract Only** **c48**
A. M. Chernyakova, S. G. Poyarkov, S. O. Borodkin, and Ye. A. Akhmetyeva *In its* USSR Report: Earth Sciences 22 May 1987 p 51 Transl. into ENGLISH from Okeanologiya (Moscow, USSR), v. 26, no. 5, Sep. - Oct. 1986 p 768-772 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

Studies of the hydrochemical structure of waters in the energy-active zone of the Gulf Stream system were made on the fifth cruise of the Vityaz. The studied area fell at the coordinates 36 to 40 degrees N, and 60 to 64 degrees W, where a quasistationary Gulf Stream meander is situated. Three test range surveys were made. Sea water samples were taken from 18 standard horizons (0 to 2,000 m). Measurements were made of oxygen dissolved in sea water, content of phosphates, nitrates and silicic acid. The studies made it possible to clarify the main patterns of vertical distribution of chemical elements. The following types of hydrochemical structure were defined: Sargasso Sea, Gulf Stream proper, eddy formations and slope waters. A distinguishing

feature for the considered structures is that the absolute concentrations of chemical characteristics in the extremal layers are virtually identical for all structures. It is clear that hydrochemical parameters can be used successfully as reliable identifiers of different types of waters, often being more representative than hydrological parameters in such dynamically complex regions as the Gulf Stream frontal zone. Author

**N88-14477#** Joint Publications Research Service, Arlington, Va.
**CORRELATION BETWEEN REFRACTION OVER SEA AND NATURE OF RADAR REFLECTIONS FROM SEA SURFACE Abstract Only** **c43**
V. A. Genkin, S. P. Kalenichenko, V. M. Leonov, and V. R. Loshakov *In its* USSR Report: Earth Sciences 22 May 1987 p 57 Transl. into ENGLISH from Okeanologiya (Moscow, USSR), v. 26, no. 5, Sep. - Oct. 1986 p 838-842 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

An effort was made to clarify information concerning the degree of refraction in the centimeter range of radio waves. The variability of refraction exerts an influence on the characteristics of radar reflections from the sea surface which can be used in determining the parameters of the sea surface. In this process it is necessary to separate variations of reflections due to variability of the sea surface from variations caused by the variability of refraction. It was necessary to derive a more detailed dependence of the intensity of reflections on range and to ascertain the influence of refraction on this dependence. Radar measurements revealed significant changes in the main parameters of the range characteristic (its shape and front) as a function of range. The range characteristic extent was the maximum range where the reflected signal was equal to the threshold signal, comparable with the level of internal noise of the radar detector. A three level evaluation of the degree of refraction, based on the shape of the range characteristic of radar reflections, is proposed. Author

**N88-14478#** Joint Publications Research Service, Arlington, Va.
**MODERN CONCEPT CONCERNING TRANSPORT OF BOTTOM SEDIMENTS IN ABYSSAL REGIONS OF WORLD OCEAN Abstract Only** **c48**
A. A. Chistyakov and R. Ye. Krasovskaya *In its* USSR Report: Earth Sciences 22 May 1987 p 65 Transl. into ENGLISH from Ekspress-Informatsiya. Seriya: Morskaya Geologiya i Geofizika (Moscow, USSR), no. 11, 1986 p 1-7 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

A comprehensive study was made of processes of movement of sediment in the bottom boundary layer in a test range off Nova Scotia at depths as great as 5,000 m. Observations revealed that at depths of less than 4,000 m there are no traces of the effects of bottom currents. At depths of 4,000 to 4,500 m or more, forms appear which are attributable to bottom currents. Maximum velocities (up to 74 cm/s) of bottom currents are attained at depths of 5,000 m, causing an increased concentration of suspended particles in the boundary layer. The research demonstrated that at depths greater than 2,000 to 3,000 m there is a quite intensive transport and redeposition of surface sediments as a result of the presence of different kinds of bottom currents. Operating over a sufficiently long time, bottom currents can cause considerable erosion of sediments, resulting in gaps in geological sections. Paleocurrents of this type probably played an important role in the formation of ferromanganese nodules. Author

**N88-14479#** Joint Publications Research Service, Arlington, Va.
**EFFECTIVE METHODS OF GRAVIMETRIC AND MAGNETOMETRIC DATA PROCESSING Abstract Only** **c46**
S. M. Oganesyan, A. G. Manukyan, and M. G. Oganesyan *In its* USSR Report: Earth Sciences 22 May 1987 p 85 Transl. into ENGLISH from Izvestiya Akademii Nauk Armlyanskoy SSR: Nauki o Zemle (Yerevan, USSR), v. 39, no. 5, Sep. - Oct. 1986 p 35-39 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

Major results related to the development of methods for processing gravimetric and magnetometric data for the construction of three dimensional geophysical models of the Earth's crust are discussed. The theoretical results and effective numerical methods for solving direct and inverse problems in gravimetry and magnetometry which were developed allow the construction of algorithms for computation of three dimensional geophysical models of the crust and upper mantle as well as for structures promising the presence of oil, gas and other useful minerals. Author

**N88-14480#** Joint Publications Research Service, Arlington, Va.
**POLAR GEOPHYSICAL INSTITUTE'S STUDIES OF MAGNETOSPHERE, IONOSPHERE Abstract Only** **c46**
*In its* USSR Report: Earth Sciences 22 May 1987 p 96 Transl. into ENGLISH from NTR: Problemy i Resheniya (USSR), 4-17 Nov. 1986 p 5 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

The institute's scientists study the structure of the magnetosphere as a medium in which radio waves are propagated and try to forecast its condition. They are working to solve problems of stable operation of radio communication and navigation systems and of precise time-keeping. Methods were developed for the utilization of the magnetosphere's natural electromagnetic radiation in geophysical prospecting. The institute takes part in international programs to create artificial auroras and to conduct high altitude aerophysical experiments. Author

**N88-14481#** Joint Publications Research Service, Arlington, Va.
**A 1,000-WATT SOLAR POWER UNIT FOR FAR NORTH Abstract Only** **c44**
V. Artemenko *In its* USSR Report: Earth Sciences 22 May 1987 p 97 Transl. into ENGLISH from Pravda (Moscow, USSR), 5 Dec. 1986 p 3 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

A solar power station, Arktika, was developed for arctic regions. It powers geodetic and navigational instruments during the dark arctic days. A working model was successfully tested on an island in the Barents Sea. The power of the permanent station will be two and one half times as great as the 400 watt model. With the assistance of industrial enterprises, the institute is ready to put solar power stations for the arctic regions into production. Author

# 43 EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

**N88-14482*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**FIRST FLIGHT OF THE ATMOS INSTRUMENT DURING THE SPACELAB 3 MISSION, APRIL 29 THROUGH MAY 6, 1985 Final Report**
Crofton B. Farmer, Odell F. Raper, and Fred G. OCallaghan 1 Oct. 1987 50 p
(Contract NAS7-918)
(NASA-CR-182360; JPL-Pub-87-32; NAS 1.26:182360) Avail: NTIS HC A03/MF A01 CSCL 13B

The underlying rationale and the implementation of the Atmospheric Trace Molecule Spectroscopy (ATMOS) investigation are discussed, a description of the sensor is given, and the ground tests and integration procedures leading to the Spacelab 3 flight are described. The data reduction and analysis procedures used after the flight are discussed, a number of examples of the spectra obtained are shown, and the concentration profiles as a function of altitude for the minor and trace gases measured during the mission are presented. On the basis of the instrument's ability to

survive both the launch and the reentry of the shuttle and its flawless performance while on orbit, the concepts involved in the investigation have been proved by the Spacelab 3 flight, and an extended series of reflights is currently being planned as a part of the Atmospheric Laboratory for Applications and Science (ATLAS) Missions. The goals for the investigation during these missions are also discussed. Author

**N88-14483** Wageningen Agricultural Univ. (Netherlands).
**APPLICATION OF REMOTE SENSING TO AGRICULTURAL FIELD TRIALS Ph.D. Thesis**
J. G. P. W. Clevers Apr. 1986 227 p
(ISBN-90-6754-089-7; ISSN-0169-345X; B8677421; PUB-86-4(1986); ETN-88-91349) Copyright Avail: Issuing Activity

Use of remote sensing to support and/or replace conventional agricultural field measurements in field trials by enabling quantitative information about an entire field trial to be obtained instantaneously, repeatedly, and nondestructively was assessed. Black and white multispectral aerial photography (visible and near infrared) is shown to be the most appropriate technique. The validity of canopy spectral reflectance factors, derived by a method of calibration and data correction, is demonstrated. A simplified reflectance model for vegetation is derived for estimating leaf area index (LAI) during the whole growing season by means of a corrected infrared reflectance factor. The latter factor is derived from the infrared reflectance by correcting for the reflectance of the background (soil and yellow leaves). Statistical analysis of field trials reveals that the presence of treatment effects can be shown with larger power and that coefficients of variation are smaller for the LAI estimated by the simplified reflectance model than for the LAI measured in the field. ESA

**N88-14484#** Commission of the European Communities (Luxembourg).
**REMOTE SENSING IN MINERAL EXPLORATION**
D. W. Coller, M. F. Critchley, J. M. Dolan, C. MacDonaill, and C. J. Murphy 1986 175 p
(PB87-138558; EUR-10334-EN) Avail: NTIS HC E07/MF E07; customers in the European Community countries should apply to the Office for Official Publications of the European Communities, B.P. 2985, Luxembourg CSCL 08G

The contents of this report on Remote Sensing in Mineral Exploration include the following: Structural, remote sensing and multivariate correlation methods as aids to mineral exploration in Central Ireland; Analysis of LANDSAT imagery from East Greenland; Airborne remote sensing in East Greenland; Computer correlation of exploration data for the Pennine orefields; Remote sensing in South Greenland; Methodology for locating subsurface domes by remote sensing. Description of some of the results of the past research and development program of the European Community on primary raw materials (1978 to 1981) as well as more recent work concerning the development and application of remote techniques in mineral exploration, as well as some more recent work in the field are given. GRA

**N88-14485#** Electronics Research Lab., Adelaide (Australia).
**FAST, COLOUR DISPLAYS OF DIGITAL TERRAIN ELEVATION DATA**
M. J. Dowling and S. C. McAuley Nov. 1986 56 p
(AD-A185596; ERL-0393-TM) Avail: NTIS HC A04/MF A01 CSCL 08B

Software has been developed to provide the following displays of digital terrain elevation data with a given map area: (a) A countour plot with one or more visibility diagrams, (b) An oblique view of the map area from any azimuth or elevation angle, (c) A perspective view of a specified sector from a selected viewpoint, and (d) A point-to-point line-of-sight profile. Emphasis has been placed on making the software easy to use, on generating the displays as quickly as possible, and on making effevtive use of color. GRA

**N88-14461#** Joint Publications Research Service, Arlington, Va.
**USES OF AIRBORNE LASER CHAYKA-1 FOR PROBING WATER, LAND SURFACES Abstract Only**
V. Lagovskiy *In its* USSR Report: Earth Sciences 22 May 1987 p 24-25 Transl. into ENGLISH from Sotsialisticheskaya Industriya (Moscow, USSR), 11 Dec. 1986 p 4 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14477#** Joint Publications Research Service, Arlington, Va.
**CORRELATION BETWEEN REFRACTION OVER SEA AND NATURE OF RADAR REFLECTIONS FROM SEA SURFACE Abstract Only**
V. A. Genkin, S. P. Kalenichenko, V. M. Leonov, and V. R. Loshakov *In its* USSR Report: Earth Sciences 22 May 1987 p 57 Transl. into ENGLISH from Okeanologiya (Moscow, USSR), v. 26, no. 5, Sep. - Oct. 1986 p 838-842 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

# 44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *28 Propellants and Fuels.*

**N88-14486*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**HOT PISTON RING TESTS Final Report**
David J. Allen (Sverdrup Technology, Inc., Middleburg Heights, Ohio.) and William A. Tomazic Dec. 1987 17 p Presented at the 25th Automotive Technology Development Contractors' Coordination Meeting, Dearborn, Mich., 26 Oct. 1987; sponsored by DOE
(Contract DE-AI01-85CE-50112)
(NASA-TM-100256; E-3808; NAS 1.15:100256; DOE/NASA/50112-72) Avail: NTIS HC A03/MF A01 CSCL 10B

As part of the DOE/NASA Automotive Stirling Engine Project, tests were made at NASA Lewis Research Center to determine whether appendix gap losses could be reduced and Stirling engine performance increased by installing an additional piston ring near the top of each piston dome. An MTI-designed upgraded Mod I Automotive Stirling Engine was used. Unlike the conventional rings at the bottom of the piston, these hot rings operated in a high temperature environment (700 C). They were made of a high temperature alloy (Stellite 6B) and a high temperature solid lubricant coating (NASA Lewis-developed PS-200) was applied to the cylinder walls. Engine tests were run at 5, 10, and 15 MPa operating pressure over a range of operating speeds. Tests were run both with hot rings and without to provide a baseline for comparison. Minimum data to assess the potential of both the hot rings and high temperature low friction coating was obtained. Results indicated a slight increase in power and efficiency, an increase over and above the friction loss introduced by the hot rings. Seal leakage measurements showed a significant reduction. Wear on both rings and coating was low. Author

**N88-14487*#** Washington Univ., Richland. Joint Center for Graduate Study.
**INVESTIGATION OF SILICON SURFACE PASSIVATION BY SILICON NITRIDE FILM DEPOSITION Final Report, 1 Sep. 1983 - 31 Aug. 1986**
L. C. Olsen Sep. 1986 134 p
(Contracts NAS-7-100; JPL-56614)
(NASA-CR-182350; NAS 1.26:182350; DE87-014403; DOE/JPL-956614/1) Avail: NTIS HC A07/MF A01 CSCL 10A

During this last (3rd) year of the program, efforts concentrated on SiN/sub x/ passivation studies. In particular, the key objectives were: relate the density of states at SiN/sub x//Si interfaces to the substrate dopant concentration; characterize the SiN/sub x//Si interface on high efficiency cells; and identify dominant current loss mechanisms in high efficiency cells. The interface state density (D/sub ss/) at the SiN/sub x//Si interface of Al/SiN/sub x//Si MIS structures was determined using high frequency and slow ramp capacitance-voltage (C-V) measurements. Values of D/sub ss/ were obtained for a range of substrate resistivities, and for both N- and P-type material. The surfaces of high efficiency N/P and P/N solar cells were characterized by using a special structure which allows simultaneous measurement of the interface recombination velocity. Dominant current loss mechanisms were determined from temperature dependent I-V analyses. The remainder of this report consists of discussions of the following: surface characterization of homogeneously doped substrates and solar cells; studies of high efficiency cells; and conclusions concerning this year's effort. DOE

**N88-14488#** Pacific Northwest Labs., Richland, Wash.
**A PROCESS STUDY OF THE BIOTHERMAL CONVERSION OF WATER HYACINTHS TO METHANE**
R. S. Butner, D. C. Elliott, L. J. Sealock, Jr., and D. P. Chynoweth May 1987 29 p Presented at the 9th Symposium on Biotechnology for Fuels and Chemicals, Boulder, Colo., 5 May 1987 Prepared in cooperation with Florida Univ., Gainesville
(Contract DE-AC06-76RL-01830)
(DE88-000554; PNL-SA-14552; CONF-870523-5) Avail: NTIS HC A03/MF A01

A hybrid process employing both biological and thermochemical conversion of biomass to methane was studied. A unique high-moisture catalytic gasifier concept was used to gasify the effluent from an anaerobic digester. An ASPEN-PLUS/sup tm/ simulation of the process concept was based upon experimental data obtained from individual process components. An overall process efficiency of 78.1 to 94.1 percent was determined, depending upon the process configuration. Extensive use of heat and power recovery is required to achieve the high efficiencies reported for the process. DOE

**N88-14489#** Battelle Columbus Labs., Ohio.
**EXTENDED ABSTRACTS: EIGHTH BATTERY AND ELECTROCHEMICAL CONTRACTORS' CONFERENCE**
Nov. 1987 318 p Conference held at Tysons Corner, Va., 16 Nov. 1987 Prepared in cooperation with Battelle Pacific Northwest Lab., Richland, Wash.
(Contract DE-AC06-76RL-01830)
(DE88-000960; CONF-871121-Summs) Avail: NTIS HC A14/MF A01

This document contains the extended abstracts for presentations scheduled at the Eighth Battery and Electrochemical Contractors' Conference, highlighting research supported by the US Department of Energy and the Electric Power Research Institute. It is intended to be a technical overview for engineers and scientists in government, industry, and academia who are interested in learning more about electrochemical energy storage. The abstracts are grouped according to the following technical sessions: Introductory Session; Sodium/Sulfur Battery Development; Aqueous Battery Development; Performance Testing, and Demonstration; Planning, Analysis, and Technology Transfer; Applied Science Research; Metal/Air Batteries; and Fuel Cells. DOE

**N88-14490#** Chevron Research Co., Richmond, Calif.
**DEVELOPMENT OF MECHANICALLY STACKED TANDEM CONCENTRATOR CELLS**
J. A. Cape, L. M. Fraas, P. S. McLeod, and L. D. Partain Oct. 1987 69 p Prepared in cooperation with Sandia National Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE88-001926; SAND-87-7009) Avail: NTIS HC A04/MF A01

Mechanically stacked, multijunction (MSMJ) solar cells offer an excellent prospect for significantly increased efficiencies in the near term. In this work, we examine several new concepts for a MSMJ solar cell. These MSMJ cell concepts include the following: a GaAsP cell grown on a GaP substrate for stacking onto a silicon cell; a GaSb cell grown lattice-matched on a GaSb substrate for stacking beneath a GaAs cell; and a Ge cell for stacking beneath a GaAs cell. The growth of GaAsP and of GaSb by vacuum chemical epitaxy and the development of GaSb solar cells are described. The development of a germanium solar cell and of a 26.1 percent GaAs/Ge MSMJ cell is also described. Finally, this work has identified approaches for achieving efficiencies with a MSMJ cell in excess of 30 percent. DOE

**N88-14491#** Electricity Council Research Centre, Capenhurst (England).
**PRACTICAL PHOTOCHEMISTRY: GENERAL CONSIDERATIONS**
J. Hutchison May 1986 26 p
(PB87-123386; ECRC/M-2067) Avail: NTIS HC E05/MF E05 CSCL 10A

Practical aspects of laboratory scale preparative photochemistry are discussed under the headings of: (1) lamps: dimensions, power ratings, spectral distributions and output intensities of different lamp types; (2) the reaction mixture: factors involved in establishing the most suitable wavelength region to use to carry out a particular reaction; the selection of the appropriate solvents, filters, and glassware; concentration of the photoactive component; (3) preparative photoreactions: immersion well, falling film, external irradiation and elliptical configurations; (4) apparatus for quantitative work: carousel and optical bench arrangements; (5) hazards: effects of ultraviolet radiation on eyes and skin and precautions to be taken. Author

**N88-14492*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**AIRBORNE TRACKING SUNPHOTOMETER APPARATUS AND SYSTEM Patent**
Yutaka Matsumoto, inventor (to NASA), Cesar Mina, inventor (to NASA), Philip B. Russell, inventor (to NASA), and William B. vanArk, inventor (to NASA) 1 Dec. 1987 10 p Filed 29 Jan. 1986 Supersedes N86-21982 (24 - 12, p 1975)
(NASA-Case-ARC-11622-1; US-Patent-4,710,618; US-Patent-Appl-SN-823712; US-Patent-Class-250-203R; US-Patent-Class-126-425) Avail: US Patent and Trademark Office CSCL 10A

An airborne tracking Sun photometer apparatus has a rotatable dome. An azimuth drive motor is connected to rotate the dome. The dome has an equatorial slot. A cylindrical housing is pivotally mounted inside the dome at the equatorial slot. A photometer is mounted in the housing to move in the equatorial slot as the housing pivots. The photometer has an end facing from the slot with an optical flat transparent window. An elevation drive motor is connected to pivot the cylindrical housing. The rotatable dome is mounted in the bulkhead of an aircraft to extend from the interior of the aircraft. A Sun sensor causes the photometer to track the Sun automatically. Alternatively, the photometer may be oriented manually or by computer.
Official Gazette of the U.S. Patent and Trademark Office

**N88-14493*#** TRW Space Technology Labs., Redondo Beach, Calif. Engineering and Test Div.
**DESIGN, FABRICATION AND DELIVERY OF A MINIATURE CASSEGRAINIAN CONCENTRATOR SOLAR ARRAY SYSTEM Final Technical Report**
Mark A. Kruer Oct. 1987 220 p
(Contract NAS8-36159)
(NASA-CR-179237; NAS 1.26:179237; Rept-45050-6001-UT-001) Avail: NTIS HC A10/MF A01 CSCL 10A

The optical design of the miniature Cassegrainian concentrator (MCC) element was improved for both offpoint and onpoint power capability. The cell stack design has shown no losses under the high short term thermal stresses imposed by component level

test and is projected to be capable of greater than five years thermal cycle life in low Earth orbit. The structural design met all requirements for stiffness and flatness and requires adjustable inserts for fine tuning of the GFRP structure to meet flatness goals. The completed, fully populated small and large MCC panels deliverable under this contract perform electrically as expected. A solid acceptance inspection program to guarantee quality of all purchased parts, and continued manufacturing process improvements will make the MCC design a viable low cost alternative to standard flat panel technology. Minor improvements to the cell stack design of the MCC element can make significant improvements in both the performance and manufacturability of the MCC system. Author

**N88-14494#** Rome Univ. (Italy). Dipartimento di Fisica.
**THERMOELECTRIC POWER IN DISORDERED ELECTRONIC SYSTEMS NEAR THE ANDERSON TRANSITION**
C. Castellani, C. DiCastro, M. Grilli, and G. Strinati 17 Mar. 1987 11 p
(Preprint-547; ETN-88-91260) Avail: NTIS HC A03/MF A01

The number-heat density correlation function for a noninteracting disordered electronic system, is evaluated at small wave vector and frequency by diagrammatic techniques. It is shown to meet its general hydrodynamic requirements. This suggests that the ratio of the coefficient of thermoelectric power and of the temperature diverges at the localization transition. ESA

**N88-14495#** Stanford Univ., Calif. Dept. of Materials Science and Engineering.
**HYDROXIDE ION CONDUCTORS AS POSSIBLE ELECTROLYTES IN INTERMEDIATE TEMPERATURE FUEL CELLS**
Lie-Yea Cheng, Steven Crouch-Baker, and Robert A. Huggins 30 Jul. 1987 3 p
(Contract N00014-84-K-0648)
(AD-A185508; TR-5) Avail: NTIS HC A02/MF A01 CSCL 07B

Prior work has shown that materials in the lithium aluminum hydroxide system can be used as hydroxide ion-conducting electrolytes at intermediate temperatures. It has been proposed that such materials may be of use as electrolytes for the electric decomposition of water. In this work, preliminary results concerning the use materials in this system as possible fuel cell electrolytes at intermediate temperatures will be presented. The AC ionic conductivity and thermal behavior of a material of nominal composition Li5AiO4 have been studied previously. A large, sudden increase in the ionic conductivity of Li5AlO4 in a wet environment at approximately 450 C was observed. Such behavior was not observed in a dry environment. Pure LiOH was found to exhibit similar behavior, and it was suggested that the observed conductivity increase in a wet environment is due to the formation of LiOH. In this work, preliminary results concerning the use of compositions within the Li - Al - H system as possible fuel cell electrolytes at intermediate temperatures will be presented. GRA

**N88-14496#** Science Applications International Corp., San Diego, Calif.
**A 40-kW FUEL CELL FIELD TEST SUMMARY UTILITIES ACTIVITIES REPORT Final Report, Jun. 1981 - Jun. 1987**
W. C. Racine and T. C. Londos Jul. 1987 85 p
(Contract GRI-5014-344-0193)
(PB88-112800; SAIC-87/1730; GRI-87/0205) Avail: NTIS HC A05/MF A01 CSCL 10B

Forty six 40 kW fuel cell power plants were field tested by 37 host participants at 42 sites in a variety of commercial, light industrial and multifamily residential applications. The participants obtained over 300,000 hours of operating experience with the power plants covering a diverse range of applications for power plant electricity and heat utilization in both single and multiple unit installations. Author

**N88-14497#** Case Western Reserve Univ., Cleveland, Ohio. Center for Electrochemical Sciences.
**ELECTROCHEMICAL CHARACTERISTICS OF ACID ELECTROLYTES FOR FUEL CELLS Annual Report, Jul. 1986 - Jun. 1987**
M. Razaq, A. Razaq, and E. Yeager Jul. 1987 102 p
(Contract GRI-5084-260-1108)
(PB88-104641; GRI-87/0233) Avail: NTIS HC A06/MF A01 CSCL 10C

Electrochemical characterization of a number of perfluorinated acids was carried out with the emphasis on the identification of alternate acids which could replace the presently used H3PO4 in the H2-O2 fuel cells. The activity for O2 reduction in the perfluorinated acids on smooth Pt and on high surface area Pt catalyzed electrodes (10 percent Pt on Vulcan XC-72) was examined. The cathode potential for O2 reduction in CF3PO(OH)2 and (CF3SO2NHSO2CF2CF2)2 is significantly higher than H3PO4. The perfluorinated acids with two terminal functional groups do not wet Teflon and could be very useful in the fuel cells. The solubilities and the diffusion coefficient of O2 in the perfluorinated acids are higher than H3PO4; over an order of magnitude and a factor of 5 to 6 respectively. The specific conductivities of the dilute perfluorinated acids are higher than phosphoric acid whereas the specific conductivities of the concentrated perfluorinated acids, particularly the imides, are lower than 85 percent phosphoric acid. A number of the perfluorinated acids with longer fluorocarbon tails were tested as additivies in 85 percent H3PO4. Author

**N88-14481#** Joint Publications Research Service, Arlington, Va.
**A 1,000-WATT SOLAR POWER UNIT FOR FAR NORTH Abstract Only**
V. Artemenko *In its* USSR Report: Earth Sciences 22 May 1987 p 97 Transl. into ENGLISH from Pravda (Moscow, USSR), 5 Dec. 1986 p 3 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

# 45 ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

**N88-14498#** Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
**ON-SITE METEOROLOGICAL PROGRAM GUIDANCE FOR REGULATORY MODELING APPLICATIONS**
Jun. 1987 187 p
(PB87-227542; EPA/450/4-87/013) Avail: NTIS HC A09/MF A01 CSCL 13B

The Environmental Protection Agency's (EPA) guidance on the collection and use of on-site meterological data for regulating modeling applications is provided. It will form the basis for the regulatory review of proposed meteorological monitoring plans by the EPA Regional Offices and States. Comprehensive and detailed guidance for on-site meteorological measurement programs are contained, covering initial design and siting of a system through data recording and processing, up to air quality model input. GRA

**N88-14499#** Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
**INTEGRATED GLOBAL BACKGROUND MONITORING NETWORK**
G. B. Wiersma, J. F. Franklin, A. Kohler, H. Croze, and C. Boelcke (United Nations Environment Program, Nairobi, Kenya ) Dec. 1986 31 p Presented at the 5th US-USSR Symposium on Comprehensive Analysis of the Environment, Washington, D.C., 10 Dec. 1986
(Contract DE-AC07-76ID-01570)
(DE88-001503; EGG-M-39086; CONF-861269-2) Avail: NTIS HC A03/MF A01

One of the more significant problems when trying to determine what impact pollutants are having on global cycles is not knowing

what natural levels should be for both abiotic (gases, trace elements) and biotic (ecosystem functions) processes. It is believed that a well designed, coordinated network of baseline stations in remote areas around the world can provide a data base that will allow best current estimates to be made of biotic and abiotic baseline conditions. These baseline conditions will then help us make better comparisons with more impacted areas, and thus help us more fully understand the impact man is having on his world. This paper examines the history of background pollution monitoring at the international level, describes current activities in the field of integrated background monitoring, and proposes criteria for the development of a global network of baseline stations to coordinate background monitoring for the presence, accumulation and behavior of pollutants in remote ecosystems. In this paper, this network is called the Integrated Global Background Monitoring Network. DOE

**N88-14500*#** ST Systems Corp., Hampton, Va.
**THE DETERMINATION OF EXHAUST CLOUD DIMENSIONS FROM FILMS OF SPACE SHUTTLE LAUNCHES**
R. A. Zak Washington NASA Dec. 1987 54 p
(Contract NAS8-36715)
(NASA-CR-4103; NAS 1.26:4103) Avail: NTIS HC A04/MF A01 CSCL 13B

Principles of photogrammetry are used to calculate the dimension of ground clouds produced from the Space Shuttle launch system. For each of three launches (Missions 41C, 41D, and 51A), a 16 mm camera recorded the ground cloud from three different locations. Measurements were made from outlines of the cloud and other features of interest which were traced onto paper at one-minute intervals using a 16 mm stop-action projector. Cloud characteristics such as top, max width at top, average width, and base are presented as a function of time. A temperature inversion was present each launch day and the cloud responded by first rising into the inversion and then descending to about the inversion height. Max tops were achieved in about three to five minutes and ranged from 2200 m for Mission 41C to 3500 m for Mission 41D. Cloud bases rose steadily to between 700 and 1000 m after 10 minutes. Average widths ranged from 500 to 1700 m depending on mission and camera. Photographs of digitizations of selected film frames are included in the report to show the irregular cloud shapes. Error sources for this analysis are also discussed. Author

**N88-14501#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
**A REVIEW OF ATMOSPHERIC OZONE AND CURRENT THINKING ON THE ANTARCTIC OZONE HOLE M.S. Thesis**
Randolph A. Fix 1987 98 p
(AD-A185608; AFIT/CI/NR-87-46T) Avail: NTIS HC A05/MF A01 CSCL 04A

A general review of the formation, global distribution and concentration variations on different temporal scales of atmospheric ozone is presented. The nature and extent of the recently discovered Antarctic ozone hole is discussed and summaried of the various theories that have been advanced to account for this phenomenon are reviewed. GRA

# 46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

**N88-14502*#** International Council of Scientific Unions, Urbana, Ill.
**MIDDLE ATMOSPHERE PROGRAM. HANDBOOK FOR MAP, VOLUME 25**
R. G. Roper, ed. Aug. 1987 435 p Proceedings of the 1st GLOBMET Symposium, Dushanbe, USSR, 19-24 Aug. 1985 Sponsored by NASA and UNESCO
(NASA-CR-181571; NAS 1.26:181571; MAP-HANDBOOK-25)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

GLOBMET (the Global Meteor Observation System) was first proposed by the Soviet Geophysical Committee and was accepted by the Middle Atmosphere Program Steering Committee in 1982. While the atmospheric dynamics data from the system are of primary interest to MAP, GLOBMET also encompasses the astronomical radio and optical observations of meteoroids, and the physics of their interaction with the Earth's atmosphere. These astronomical observations and interactional physics with the Earth's atmosphere are discussed in detail. For individual titles, see N88-14503 through N88-14560.

**N88-14503*#** Academy of Sciences of the Tajik SSR, Doushanbe. Inst. of Astrophysics.
**DYNAMICS OF METEOR STREAMS** **c90**
P. B. Babadjanov and Yu. U. Obrubov *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 2-10 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

The overwhelming majority of meteor streams are generally assumed to be formed due to the decay of comets. The most effective process of the release of solid particles from a cometary nucleus is their ejection by sublimating gases when the comet approaches the Sun. The results of investigation of the Geminids and Quadrantids meteor stream evolution show that under the influence of planetary perturbations, the stream may originally be flat but then thicken depending on the variation range of orbital inclinations. Eventually, due to planetary perturbations, a meteor stream may take such a shape as to cause the start of several active showers at different solar longitudes. Author

**N88-14504*#** Academy of Sciences (USSR), Ashkhabad. Inst. of Physical Technology.
**ELEMENTARY PROCESS AND METEOR TRAIN SPECTRA** **c90**
O. G. Ovezgeldyev *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 11-21 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

Mechanisms of excitation of individual spectral line radiation were studied experimentally and theoretically and it was demonstrated that such processes as oxidation, resonant charge exchange, dissociative recombination and others play an important part in the chemistry of excited particles. The foundation was laid toward simulating the elementary processes of meteor physics. Having a number of advantages and possibilities, this method is sure to find a wide use in the future. Author

**N88-14505*#** Soviet Geophysical Committee, Moscow (USSR).
**THE ARCHIVING OF METEOR RESEARCH INFORMATION** **c82**
V. A. Nechitailenko *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 22-30 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 05B

The results obtained over the past years under GLOBMET are not reviewed but some of the problems the solution of which will guide further development of meteor investigation and international cooperation in this field for the near term are discussed. The main attention is paid to problems which the meteor community itself can solve, or at least expedite. Most of them are more or less connected with the problem of information archiving. Information archiving deals with methods and techniques of solving

two closely connected groups of problems. The first is the analysis of data and information as an integral part of meteor research and deals with the solution of certain methodological problems. The second deals with gathering data and information for the designing of models of the atmosphere and/or meteor complex and its utilization. These problem solutions are discussed.
Author

**N88-14506*#** Institute of Experimental Meteorology, Obninsk (USSR).
**THE CLIMATIC WIND REGIME IN THE LOWER THERMOSPHERE FROM METEOR RADAR OBSERVATIONS**
**c47**
Yu. I. Portnyagin *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 31-44 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04B

The determination of climatic norms of wind regime parameters in the lower thermosphere requires some questions of a methodical and scientific character to be settled. Among those of methodical character is: how to properly construct climatic circulation models using limited experimental data obtained by various methods during different time periods and in different geographical regions. The most important questions of a scientific character are: what main dynamic structures characterize the wind regime and how are these structures related to various atmospheric parameters and to the dynamic structures in the overlying and underlying atmospheric layers. These questions are considered and discussed. Author

**N88-14507*#** Kyoto Univ., Uji (Japan). Radio Atmospheric Science Center.
**METEOR OBSERVATION BY THE KYOTO METEOR RADAR**
**c90**
Susumu Kato and Toshitaka Tsuda *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 45-49 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

The Kyoto Meteor Radar is a monostatic coherent pulsed Doppler radar operating on the frequency of 31.57 MH. The system is computer controlled and uses radio interferometry for echo height determination. The antenna, an improvement, can be directed either to the north or the east. The system has been continuously collecting data on winds at meteor heights by radar observation. The meteor echo rate was also measured, the echo rate distribution with height and the daily variation in height integrated echo rate are discussed. Investigations of atmospheric tides are being pursued by cooperative observations. A novel approach to the study of gravity waves was attempted using the meteor radar which is able to detect the horizontal propagation of the waves by observing the changing phase through the region illuminated by the radar.
Author

**N88-14508*#** Kharkovskii Inst. Radioelektroniki (USSR).
**ATMOSPHERE DYNAMICS IN THE EQUATORIAL METEOR ZONE**
B. L. Kascheev *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 50-57 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The study of the atmospheric circulation of the Earth from its surface to the altitudes of 100 to 110 km is essential for establishing atmospheric motion regularities with a view toward perfecting weather forecasting. The main results of the Soviet equatorial meteor expedition (SEME) are presented. A continuous cycle of measurements was carried out. Considerable interdiurnal variation of the zonal component was observed. Importantly, in the meridional component, the prevalence of a two day component was established in the equatorial meteor zone for the first time. The pronounced westward motion of the atmosphere over the equator is noted. The SEME data analysis has shown that the meteor zone is characterized by flashes of intensity of the internal gravity waves and turbulence at highest instability moments of atmosphere due to tidal motion.
Author

**N88-14509*#** Academy of Sciences, Kuhlungsborn (East Germany).
**LONG-PERIOD VARIATIONS OF WIND PARAMETERS IN THE MESOPAUSE REGION AND THE SOLAR CYCLE DEPENDENCE**
K. M. Greisiger, R. Schminder, and D. Kuerschner (Leipzig Univ., East Germany ) *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 58-61 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The solar cycle dependence of wind parameters below 100 km on the basis of long term continuous ionospheric drift measurements in the low frequency range is discussed. For the meridional prevailing wind no significant variation was found. The same comparison as for winter was done for summer where the previous investigations gave no correlation. Now the radar meteor wind measurement values, too, showed a significant negative correlation of the zonal prevailing wind with solar activity for the years 1976 to 1983. The ionospheric drift measurement results of Collm have the same tendency but a larger dispersion due to the lower accuracy of the harmonic analysis because of the shorter daily measuring interval in summer. Continuous wind observations in the upper mesopause region over more than 20 years revealed distinct long term variations, the origin of which cannot be explained with the present knowledge.
Author

**N88-14510*#** Leipzig Univ. (East Germany).
**THE LOWER THERMOSPHERE WIND REGIME FROM SIMULTANEOUS OBSERVATIONS OVER EUROASIA (COLLM, DUSHANBE, FRUNZE)**
R. Schminder, D. Kurschner, K. A. Karimov, R. B. Bekbasarov, L. A. Riazanova, R. P. Chebotarev, and Kh. Nabotov (Academy of Sciences of the Tajik SSR, Doushanbe.) *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 62-65 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The circulation in the lower thermosphere as determined from the results of measurements in 1984 is considered. Ionospheric drift measurements were taken using the method of spaced reception in the long wave range. Other measurements were taken using the D2 method. Average daily values of wind velocity were used. Discontinuity of measurements ranged from a day to a week. Preliminary data were reduced to the common average height of 93 km with the help of vertical profiles of wind velocity components. The results of measurements of zonal and meridional wind velocity components are presented. Zonal circulation changes from westerly to easterly winds were observed in winter, in periods of spring time reversal and during stratomesospheric rises in temperature.
Author

**N88-14511*#** Institute of Experimental Meteorology, Obninsk (USSR).
**WIND REGIME PECULIARITIES IN THE LOWER THERMOSPHERE IN THE WINTER OF 1983/84**
I. A. Lysenko, N. A. Makarov, Yu. I. Portnyagin, B. I. Petrov, K. M. Greisiger, R. Schminder, and D. Kurschner (Leipzig Univ., East Germany ) *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 66-69 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP

Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Temporal variations of prevailing winds at 90 to 100 km obtained from measurements carried out in winter 1983 to 1984 at three sites in the USSR and two sites in East Germany are reported. These variations are compared with those of the thermal stratospheric regime. Measurements were carried out using the drifts D2 method (meteor wind radar) and the D1 method (ionospheric drifts). Temporal variations of zonal and meridional prevailing wind components for all the sites are given. Also presented are zonal wind data obtained using the partial reflection wind radar. Wind velocity values were obtained by averaging data recorded at between 105 and 91 km altitude. Wind velocity data averaged in such a way can be related to about the same height interval to which the data obtained by the meteor radar and ionospheric methods at other sites, i.e., the mean height of the meteor zone (about 95 km). The results presented show that there are significant fluctuations about the seasonal course of both zonal and meridional prevailing winds. Author

**N88-14512*#** Kazan State Univ. (USSR).
**ON THE INTERCONNECTION OF DYNAMIC PROCESSES IN THE LOWER THERMOSPHERE WITH METEOROLOGICAL PHENOMENA IN THE TROPOSTRATOSPHERE**
A. N. Fakhrutdinova, A. M. Stepanov, and I. P. Perevedentsev *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 70-75 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Nowadays the atmosphere is considered a single dynamic system governed by inner and other factors, the separate layers (troposphere, strato-mesosphere, thermosphere) of which are in a state of interaction though they differ physically from one another in thermal stratification and energetic processes. Observational data of thermodynamic parameter connections in these layers height range are presented. The interconnection between the temperature field disturbances in the tropo-stratosphere and the dynamic regime in the lower thermosphere in winter and summer is defined as revealed by observational data. Author

**N88-14513*#** Central Aerological Observatory, Moscow (USSR).
**MEAN PRESSURE DISTRIBUTION AND GEOSTROPHIC CIRCULATION IN THE METEOR ZONE**
Yu. P. Koshelkov *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 76-100 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Boutko et al., used available satellite radiometer data to estimate 0.1 mb constant pressure heights in the mesosphere and Koshelkov and Kovshova derived, 0.1 to 0.005 mb or 0.1 to 0.001 mb layer thickness from which were compiled height fields of the 0.005 mb and 0.001 mb levels. The close relationship discovered between mean thicknesses and zonal values of atmospheric radiances observed in channel 3000 of the pressure modulated radiometer was used. An analysis of the geopotential height fields in the lower thermosphere of the Southern Hemisphere was carried out by others. The Northern Hemisphere patterns are analyzed herein. The analysis was limited to regions north of 20 N due to poor reliability of the thickness estimates from the radiometer data at low latitudes. These analyses are discussed. Author

**N88-14514*#** Central Aerological Observatory, Moscow (USSR).
**CIRCULATION IN THE MESOSPHERE AND LOWER THERMOSPHERE DURING THE MAP (MIDDLE ATMOSPHERE PROGRAM)/WINE (WINTER IN THE NORTHERN EUROPE) PERIOD**
D. A. Tarasenko *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 101-111 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

One of the scientific programs in the MAP project, Winter in the Northern Europe (WINE) 1983 to 1984 involved an analysis of circulation processes in the middle atmosphere which characterized that winter period. Rocket soundings were conducted at many stations. In order to investigate deviations of the mean winds for the MAP/WINE period from the circulation conditions of other winters and from the climatic norm, rocket sounding data of Churchill and Barrow stations was well as the Pressure Modulated Radiometer channel 3000 data enabled the compilation of geopotential fields and the calculation of winds in the geostrophic approximation for comparison with the meteor winds. The large scale processes of the winter which determined the circulation in the period of the experiment were analyzed briefly. The analysis and results are discussed. Author

**N88-14515*#** Kharkovskii Inst. Radioelektroniki (USSR).
**CHARACTERISTICS OF ATMOSPHERIC DISTURBANCES WITH A QUASI-TWO DAY PERIOD**
B. V. Kalchenko *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 112-118 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

In 1968 the Soviet equatorial meteor expedition measured, at an altitude of 80 to 105 km, wind velocity disturbances in the equatorial atmosphere with a quasi-two day period. An example of such disturbances is provided which shows time series of wind velocity in the meridional and zonal directions. The results of the time series analysis are discussed. Author

**N88-14516*#** Academy of Sciences, Kuhlungsborn (East Germany). Inst. of Atmospheric Research and Geomagnetism Observatory of Atmospheric Research.
**VARIATIONS OF THE SEMI-DIURNAL TIDAL WIND IN THE METEOR REGION WITH PERIODS OF ABOUT 27 AND 13.5 DAYS**
K. M. Greisiger *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 119-120 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Daily values of sunspot number and solar radio emission at 10.7 cm wavelength show a well known strong modulation with a period of 27 days, the Sun's rotation period. Recent satellite measurements revealed the same modulation of the ultraviolet irradiance at wavelength below 300 nm. These UV variations can influence the thermal heating of the ozone layer by altering the chemical composition. Therefore, one can also expect a corresponding variation in the middle atmosphere of the semi-diurnal tide, which is thermally excited essentially by absorption of UV between 200 and 370 nm in the upper ozone layer. Results of radar meteor wind measurements were used to detect a presumable very weak 27 day modulation within the natural and artificial noise of the daily values of the semi-diurnal wind amplitude. The summer period was chosen because of its relatively steady conditions and the maximum amplitudes during the year. The results of this investigation are given and discussed. Author

**N88-14517*#** Istituto di Fisica dell Atmosfera, Bologna (Italy).
**TIDAL ACTIVITY IN THE METEOR ZONE OVER BUDRIO, ITALY**
G. Cevolani *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 121-137 (For primary document see N88-14502 06-46)

Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

A brief survey is presented of the variations with time and height of atmospheric tides observed at Budrio (45 deg N, 12 deg E) in the wind field between 80 and 110 km altitude during the 1978 to 1982 year period. Variations of amplitude maxima mainly of the semidiurnal tide in the winter data of 1979 and 1980 show periodicities of a few days throughout the observing period. Upward propagation of tidal energy during a stratospheric warming in January 1982 is proposed to be inhibited because of instabilities in atmospheric conditions. Author

**N88-14518*#** Kazan State Univ. (USSR).

**MAIN RESULTS OF ATMOSPHERIC FINE STRUCTURE PARAMETER OBSERVATION IN THE LOWER THERMOSPHERE**

V. V. Sidorov, A. N. Fakhrutdinova, and V. A. Ganin *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 138-142 (For primary document see N88-14502 06-46)

Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The capabilities of the radiometeor method of wind measurement increase with the increase of the transmitted power of radar stations fitted with goniometric systems which enables the observation of shower meteors along with sporadic background. In shower observations the meteor zone reflecting area narrows to the echo surface which is perpendicular to the flux radiant. Favorable conditions are created for singling out atmospheric disturbances in which the wave front is parallel to the echo surface which plays, in this case, the role of a frequency filter. For the first time this technique allowed wave disturbances with periods of approx. greater than 4 min. to be measured, with about a 99 percent probability of exceeding the level of the turbulence noise, during the Geminid and Perseid showers. Maximum values of such wave disturbance amplitudes were about 15 to 20 m/s, with lifetimes up to 2 hrs. Author

**N88-14519*#** Academy of Sciences (USSR), Frunze.

**ON CONNECTION BETWEEN EVOLUTION OF TROPOSPHERE FRONTS AND CHANGES OF CIRCULATION REGIME IN METEOR ZONE**

K. A. Karimov *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 143-145 (For primary document see N88-14502 06-46)

Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The interactions between the thermobaric fields at heights from 5 to 95 km at the beginning of a winter period are considered, based on experimental radar measurements of meteor drifts obtained in Frunze in November to December 1983. During this period the high atmosphere readily responds to even slight changes in the thermal regime of the stratosphere. The interdiurnal variations of average daily values of wind u, v, U, and azimuth phi are shown. Author

**N88-14520*#** Leningrad State Univ. (USSR).

**A STUDY OF THE MECHANISM OF INTERNAL GRAVITY WAVE GENERATION BY QUASIGEOSTROPHIC METEOROLOGICAL MOTIONS**

A. S. Medvedev *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 146-152 (For primary document see N88-14502 06-46)

Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Numerous experiments on the detection of atmospheric waves in the frequency range from acoustic to planetary at meteor heights have revealed that important wave sources are meteorological processes in the troposphere (cyclones, atmospheric fronts, jet streams, etc.). A dynamical theory based on the others work include describing the adaptation of meteorological fields to the geostropic equilibrium state. According to this theory, wave motions appear as a result of constant competition between the maladjustment of the wind and pressure fields due to nonlinear effects and the tendency of the atmosphere to establish a quasi-geostrophic equilibrium of these fields. These meteorological fields are discussed. Author

**N88-14521*#** Leningrad State Univ. (USSR).

**STUDY OF INTERNAL GRAVITY WAVES IN THE METEOR ZONE**

N. M. Gavrilov *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 153-166 (For primary document see N88-14502 06-46)

Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

An important component of the dynamical regime of the atmosphere at heights near 100 km are internal gravity waves (IGW) with periods from about 5 min to about 17.5 hrs which propagate from the lower atmospheric layers and are generated in the uppermost region of the atmosphere. As IGW propagate upwards, their amplitudes increase and they have a considerable effect on upper atmospheric processes: (1) they provide heat flux divergences comparable with solar heating; (2) they influence the gaseous composition and produce wave variations of the concentrations of gaseous components and emissions of the upper atmosphere; and (3) they cause considerable acceleration of the mean stream. It was concluded that the periods, wavelengths, amplitudes and velocities of IGW propagation in the meteor zone are now measured quite reliably. However, for estimating the influence of IGW on the thermal regime and the circulation of the upper atmosphere these parameters are not as important as the values of wave fluxes of energy, heat, moment and mass.

Author

**N88-14522*#** Leningrad State Univ. (USSR).

**NUMERICAL MODELING OF TROPOSPHERE-INDUCED GRAVITY WAVE PROPAGATION**

N. M. Gavrilov and V. A. Yudin *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 167-172 (For primary document see N88-14502 06-46)

Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Sources of internal gravity waves (IGW) in the upper atmosphere are assumed to be meteorological processes in the troposphere. These sources are vertically and horizontally inhomogeneous and time dependent. In order to describe the IGW propagation from such sources, a numerical solution of a system of hydrodynamical equations is required. In addition, it is necessary to take into account the influence of the altitude latitude inhomogeneity of the temperature and wind fields on the IGW propagation as well as the processes of dissipation. An algorithm is proposed for numerical modelling of the IGW propagation over a limited area from tropospheric local sources to the upper atmosphere. The algorithm takes into account all the above features. A spectral grid method is used with the expansion of wave fields into the Fourier series over longitude. The upper limit conditions were obtained from the requirement of a limited energy dissipation rate in an atmospheric column. The no slip (zero velocity) condition was used at the Earth's surface. Author

**N88-14523*#** Leningrad State Univ. (USSR).

**A STATISTICAL STUDY OF VARIATIONS OF INTERNAL GRAVITY WAVE ENERGY CHARACTERISTICS IN METEOR ZONE**

N. M. Gavrilov and E. D. Kalov *In* International Council of

Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 173-180 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Internal gravity wave (IGW) parameters obtained by the radiometer method have been considered by many other researchers. The results of the processing of regular radiometeor measurements taken during 1979 to 1980 in Obninsk (55.1 deg N, 36.6 deg E) are presented. Author

**N88-14524*#** Institute of Experimental Meteorology, Obninsk (USSR).
**ON THE DEPENDENCE OF THE LOWER THERMOSPHERIC WIND REGIME ON THE SOLAR CYCLE**
V. A. Djachenko, I. A. Lysenko, and Yu. I. Portnyagin *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 180-185 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The lower thermosphere occupies the intermediate position between the overlying thermospheric layers, for which direct correlation of its parameters with solar variety variations is well established, and the underlying ones, where this correlation is mainly of an indirect character. Therefore, for understanding the mechanism of solar terrestrial correlation it is important to investigate the dependence of different atmospheric parameters in the lower troposphere, and of wind regime parameters in particular, on the solar activity. Several series of observations were used which include the results of meteor radar wind velocity measurements carried out in Obninsk complemented by the data obtained using the same technique at Jodrell Bank from 1953 to 1958 and in Kharkov from 1960 to 1963. The interannual variations of values averaged over these periods for prevailing wind velocities and semidiurnal harmonic amplitudes and also results for some months are presented. These results are discussed. Author

**N88-14525*#** Academy of Sciences (USSR), Frunze.
**LONGITUDINAL PECULIARITIES OF MERIDIONAL CIRCULATION IN LOWER THERMOSPHERE AND MESOSPHERE**
R. B. Bekbasarov, K. A. Karimov, and M. A. Takyrbashev *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 186-188 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Average monthly longitudinal profiles of geostrophic wind in winter are presented. Positive values correspond to meridional movements from north to south. It is concluded that the normal longitudinal meridional circulation is characterized by the presence of sectors where meridional flows do not change their direction in the course of time comparable with synoptic periods. The longitudinal distribution of meridional wind in middle latitudes taken from the analysis results of radiometeor and ionospheric stations observational data obtained in 1976 to 1980 are presented. Meridional winds have a longitudinal variability that is equivalent to both the warm and cold half years. Author

**N88-14526*#** Kazan State Univ. (USSR).
**LOWER THERMOSPHERE WIND REGIME ACCORDING TO RADIOMETEOR MEASUREMENTS IN KAZAN**
V. V. Sidorov, A. N. Fahrutdinova, and V. A. Makarov *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 189-193 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Research in dynamic processes in the lower thermosphere has been carried out in Kazan using the meteor radar facilities of the Kazan State University under the MAP-GLOBMET international program. Presented is experimental data on seasonal dependences of the wind for anomalous winter circulation periods, spring and autumn reconstructions and stable summer circulation from observations conducted in 1978 to 1984. Prevailing wind parameters are shown: zonal and meridional component amplitudes and A sub 0 and azimuth of the prevailing wind vector. The values are also presented for semidiurnal zonal and meridional tidal components, their correlation coefficient and zonal component amplitude maximum time. Author

**N88-14527*#** Kharkovskii Inst. Radioelektroniki (USSR).
**ATMOSPHERE DYNAMIC PROCESSES STRUCTURE AT 80-105 km ALTITUDE**
B. V. Kalchenko and A. N. Oleinikov *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 194-199 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Determination of wind velocity by means of Doppler meteor radars is based on the assumption that an ionized meteor trail drifts together with the neutral atmosphere. From the Doppler frequency shift it is possible to estimate the radial velocity of the trail drift. Conversion of the recorded radial velocity to the true wind velocity vector in the given space region depends both on the radar technical parameters and the chosen atmospheric motion model. The atmospheric dynamic processes structure is considered. Author

**N88-14528*#** Tbilisi State Univ. (USSR).
**INTERNAL GRAVITY WAVES IN THE METEOR ZONE IN THE TBILISI REGION**
Z. S. Sharadze, G. B. Kikhvilashvili, Z. L. Liadze, and N. V. Mosashvili *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 200-206 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The study of wave disturbances (WD) in the upper part of the meteor zone (90 to 110 km) was made in the Tbilisi region. Observations were conducted using three ionospheric vertical sounders located at the corners of a triangle spaced from each other at a distance of 50 km, a four azimuth electrophotometer by the method of space reception with a small distance and a recording unit. These disturbances are measured and the results are given. Author

**N88-14529*#** University of Northern Illinois, De Kalb.
**MESOSCALE DENSITY VARIABILITY IN THE MESOSPHERE AND THERMOSPHERE: EFFECTS OF VERTICAL FLOW ACCELERATIONS**
D. O. ReVelle *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 204-206 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

A mechanistic one dimensional numerical (iteration) model was developed which can be used to simulate specific types of mesoscale atmospheric density (and pressure) variability in the mesosphere and the thermosphere, namely those due to waves and those due to vertical flow accelerations. The model was developed with the idea that it could be used as a supplement to the TGCMs (thermospheric general circulation models) since such models have a very limited ability to model phenomena on small spatial scales. The simplest case to consider was the integration

upward through a time averaged, height independent, horizontally divergent flow field. Vertical winds were initialized at the lower boundary using the Ekman pumping theory over flat terrain. The results of the computations are summarized. Author

**N88-14530*#** Georgian Polytechnic Inst., Tbilisi.
**ON THE WAVE EXCITATION IN THE TURBULENT METEOR TRACE**
G. V. Jandieri, G. Sh. Kevanishvili, and V. I. Lenin *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 207-210 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The solution to the problem of excitation of longitudinal and transverse electromagnetic waves in randomly inhomogeneous media is reduced to the derivation of a complex effective dielectric constant (EDC) tensor which nonlocally connects together the average macroscopic electromagnetic fields in continuous media, it is implied that the field values which are rapidly fluctuating on a microscopic scale in space and time become smoothed out in a specified way due to the inhomogeneous mixing of diffusion. Proceedings from the derived general expression for the EDC tensor new modes of longitudinal and transverse electromagnetic wave generation due to fluctuation in the parameters of the medium was predicted. In this connection, it is of interest to investigate the peculiarities of electromagnetic longitudinal and transverse wave propagation in such randomly inhomogeneous media where, apart from the charged particle concentration change, the random spatial and temporal changes of natural frequency of closely located oscillators take place. Author

**N88-14531*#** Kazan State Univ. (USSR).
**METHODS AND FIRST RESULTS OF PLASMA NON-ISOTHERMAL PARAMETERS MEASUREMENTS IN METEOR TRAILS** **c75**
K. K. Kostylev and V. S. Tokhtasjev *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 211-217 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 20I

There is no reliable experimental evidence so far of either the presence or absence of nonisothermal effects in newly formed meteor trails. Neither is there a common opinion on the most effective mechanism of electron cooling. According to the laboratory experimental data collisions of atomic and molecular particles of all kinds having velocities of 10 to 70/kms often yields 1 eV electrons and not infrequently some have energies reaching several electron volts. These highest energy electrons are referred to as superhot electrons. The method of measurement and the results of these measurements in meteor trails are discussed.
Author

**N88-14532*#** Academy of Sciences of the Tajik SSR, Doushanbe.
**THE ROLE OF FRAGMENTATION IN INTERACTION OF METEOROIDS WITH THE EARTH'S ATMOSPHERE**
P. B. Babadjanov, G. G. Novikov, V. N. Lebedinets, and A. V. Blokhin *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 218-221 Prepared in cooperation with Institute of Experimental Meteorology, Obninsk (USSR) (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

As a rule, when analyzing the mechanism of quasi continuous fragmentation (QCF) it is assumed that fragments separated from the parent meteoroid (PM) are of equal initial mass. In reality, this may not be so. A major difficulty is the lack of observational data on the function of the fragment initial mass distribution and so one must resort to theoretical modeling. A discrete distribution is considered which excluded to a certain extent some mathematical difficulties. The calculation results are given and discussed.
Author

**N88-14533*#** Academy of Sciences (USSR), Ashkhabad. Inst. of Physical Technology.
**ON THE METEOR TRAIL SPECTRA** **c90**
O. G. Ovezgeldyev, S. Mukhamednazarov, R. I. Shafiev, and N. V. Maltsev *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 222-227 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

Meteor radiation appears as a result of collisions between meteoroid atoms and air molecules. Depending on duration, this radiation is usually divided into the following types: radiation of the meteor head; radiation of a coma surrounding or immediately following the meteor head; radiation of a trail formed as a result of fragments lagging behind or by the afterglow; and radiation of a meteor train forming from a tail as a result of various chemical and dynamical processes. To investigate physical processes caused by each of the above types, it is necessary to obtain the corresponding experimental data. The physical processes of the radiation and the measurement of the experimental data is discussed. Author

**N88-14534*#** Case Western Reserve Univ., Cleveland, Ohio. Dept. of Electrical Engineering and Applied Physics.
**SOME ASPECTS OF METALLIC ION CHEMISTRY AND DYNAMICS IN THE MESOSPHERE AND THERMOSPHERE**
J. D. Mathews *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 228-254 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The relationship between the formation of sporadic layers of metallic ion and the dumping of these ions into the upper mesosphere is discussed in terms of the tidal wind, classical (i.e., windshear) and other more complex, perhaps highly nonlinear layer formation mechanisms, and a possible circulation mechanism for these ions. Optical, incoherent scatter radar, rocket, and satellite derived evidence for various layer formation mechanisms and for the metallic ion circulation system is reviewed. The results of simple one dimensional numerical model calculations of sporadic E and intermediate layer formation are presented along with suggestions for more advanced models of intense or blanketing sporadic E. The flux of metallic ions dumped by the tidal wind system into the mesosphere is estimated and compared with estimates of total particle flux of meteoric origin. Possible effects of the metallic ion flux and of meteoric dust on D region ion chemistry are discussed. Author

**N88-14535*#** University of Northern Illinois, De Kalb. Meteorology Program.
**THE END HEIGHT OF FIREBALL AS A FUNCTION OF THEIR RESIDUAL KINETIC ENERGY** **c90**
D. O. ReVelle *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 255-257 Sponsored by NASA (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

Previous analyses of meteoroid compositional groupings have utilized the end height of fireballs as a diagnostic tool. From an observational perspective this definition is straight forward, but from a theoretical viewpoint there are problems with using this

operational definition. In order to realistically assess the estimated geometric uncertainty of + 1 km in the observed end height, a theoretical definition of the end height of meteoritic fireballs is proposed using the results from the integral radiation efficiency model of ReVelle. Three photographed and recovered meteorites are used as a calibration for this proposed definition. This definition was used to evaluate the end height of all fireballs that were deduced by Wetherill and ReVelle as being meteoritic. In almost all cases the theoretical values are lower than the observed values, in some cases as much as 5 km lower. A preliminary summary of results are given. Author

**N88-14536*#** Academy of Sciences of the Tajik SSR, Doushanbe.
**OZONE FORMATION DUE TO INTERACTION OF METEOROIDS WITH EARTH'S ATMOSPHERE**
R. Sh. Bibarsov *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 258-260 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

In a previous paper, it was shown that concentration of atomic oxygen in overdense meteor trails may exceed that of the normal atmosphere by a factor of several hundred times. This may lead to the formation of meteoric ozone. Therefore, it is imperative to estimate the concentration of ozone in the trails of meteor bodies with different masses. It seems that meteoric ozone must be taken into account when studying the balance of ionization in the meteor trails formed by particles with masses more than .01 g. The predicted levels of atomic oxygen and ozone seem sufficient to greatly influence the rate of meteoric plasma deionization.
Author

**N88-14537*#** Academy of Sciences of the Tajik SSR, Doushanbe.
**METEOR MATTER INTERACTION WITH THE EARTH'S ATMOSPHERE AND THE IONOSPHERIC E-REGION STRUCTURE**
O. Alimov *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 261-265 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The exploration of the ionospheric E region is a pressing problem, both in the applied and fundamental studies. Results are presented of an investigation: (1) to estimate the meteor ionization contribution to the night time E layer and influx; (2) to study the phenomenon of intensive sporadic layer formation following cessation of meteor stream activity; and (3) to access the role of metallic ions of meteor origin in the diurnal and seasonal variations in the occurrence probabilities of midlatitude E sub s. The contribution was evaluated of meteor matter, Lyman radiation and corpuscular particles to the electron concentration of the night E region. Results are discussed. Author

**N88-14538*#** Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
**THE NONLINEAR THERMODYNAMICS OF METEORS, NOCTILUCENT CLOUDS, ENHANCED AIRGLOW AND GLOBAL ATMOSPHERIC CIRCULATION**
J. Rajchl *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 266-271 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Two types of fundamental topological junctions of elements are deduced from a nonlinear thermodynamical model. Using this scheme, the possibility of a causal relation between fireballs and faint meteors as nonlinear sources on the one hand, and noctilucent clouds (NC) and Hoffmeister's enhanced airglow (EA) as complementary formative processes in the middle atmosphere and ionosphere, on the other hand, is examined. The principal role of the global atmospheric circulation in this relation is demonstrated. Such circulation in the mesosphere appears to prevent the neutral dust dissipated by fireballs from becoming an efficient agent in NLC generation. In this case, the behavior of ionized material deposited by both the bright and faint meteors is more probably controlled, as shown from the annual variation of the E sub s layer by the darkness of lunar eclipses and the global circulation of the lower thermosphere. The role of fireballs and neutral dust might be more significant as a source of EA phenomenon.
Author

**N88-14539*#** Kazan State Univ. (USSR).
**A PROCESSING METHOD AND RESULTS OF METEOR SHOWER RADAR OBSERVATIONS** **c90**
O. I. Belkovich, N. I. Suleimanov, and V. S. Tokhtasjev *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 272-279 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

Studies of meteor showers permit the solving of some principal problems of meteor astronomy: to obtain the structure of a stream in cross section and along its orbits; to retrace the evolution of particle orbits of the stream taking into account gravitational and nongravitational forces and to discover the orbital elements of its parent body; to find out the total mass of solid particles ejected from the parent body taking into account physical and chemical evolution of meteor bodies; and to use meteor streams as natural probes for investigation of the average characteristics of the meteor complex in the solar system. A simple and effective method of determining the flux density and mass exponent parameter was worked out. This method and its results are discussed. Author

**N88-14540*#** Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
**PHOTOGRAPHIC FIREBALL NETWORKS** **c90**
Z. Ceplecha *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 280-287 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

Long term radar observations of any meteor shower yield good data for a study of the features of its cross section structure in detail. The hourly rates of meteor echoes represent usually the basic data from which shower characteristics are derived. Unfortunately, the hourly rate does not depend only on the activity of the shower in question but also on the position of the shower radiant, on the mutual radiant antenna position, and on the parameters of the radar system. It is known that the knowledge of the response function of the radar is necessary for good interpretation of the hourly echo counts. A method of long term radar shower data analysis is discussed along with preliminary results. Author

**N88-14541*#** Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
**A METHOD OF LONG-TERM RADAR SHOWER DATA ANALYSIS** **c90**
M. Simek *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 288-293 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

Complex photographic and radar meteor observations have been carried out since 1957. Using the available observational data, the density of incident flux of meteoroids was estimated over a wide mass range of 0.001 to 100 g. To avoid the influence of apparatus selectivity a special technique was applied. The application of this technique to the radar shower data analysis is discussed in detail. Author

**N88-14542*#** Academy of Sciences of the Tajik SSR, Doushanbe.
**INCIDENT METEOROID FLUX DENSITY** **c90**
P. B. Badadjanov, R. Sh. Bibarsov, V. S. Getman, and V. M. Kolmakov *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 294-297 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

Complex photographic and radar meteor observations were carried out. Using the available observational data, the density of incident flux of meteoroids was estimated over a wide mass range of 0.001 to 100 g. To avoid the influence of apparatus selectivity a special technique was applied. The main characteristics of this technique are given and discussed. Author

**N88-14543*#** Kazan State Univ. (USSR).
**MODELS OF SPORADIC METEOR BODY DISTRIBUTIONS** **c90**
V. V. Andreev and O. I. Belkovich *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 298-304 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

The distribution of orbital elements and flux density over the celestial sphere are the most common forms of representation of the meteor body distribution in the vicinity of the Earth's orbit. The determination of flux density distribution of sporadic meteor bodies was worked out. The method and its results are discussed. Author

**N88-14544*#** Tomsk State Univ. (USSR).
**ON METEOR STREAM SPATIAL STRUCTURE THEORY** **c90**
G. V. Andreev *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 305-310 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

The classical spatial representation of meteor streams is an elliptical torus with variable cross section. The position of this torus in space is determined by the mean orbit elements that may be obtained directly from observations of individual meteor stream particles when crossed by the Earth. Since the orbits of individual particles of a stream differ from each other, the distance between them on a plane normal to the mean orbit of elliptical torus forms some area, i.e., a cross section. The size and form of these cross sections change with the change of the direction among the mean orbit and are completely defined by the dispersion values of the orbit elements in a stream. An attempt was made to create an analytical method that would permit description of the spatial and time parameters of meteor streams, i.e., the form and size of their cross section, density of incident flux and their variations along the mean orbit and in time. In this case, the stream is considered as a continuous flux rather than a set of individual particles. Author

**N88-14545*#** Tomsk State Univ. (USSR).
**DENSITY VARIATIONS OF METEOR FLUX ALONG THE EARTH'S ORBIT** **c90**
N. T. Svetashkova *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 311-315 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

No model of distribution of meteor substance is known to explain the observed diurnal and annual variations of meteor rates, if that distribution is assumed to be constant during the year. Differences between the results of observations and the prediction of diurnal variation rates leads to the conclusion that the density of the orbits of meteor bodies changes with the motion of the Earth along its orbit. The distributions of the flux density over the celestial sphere are obtained by the method described previously by Svetashkova, 1984. The results indicate that the known seasonal and latitudinal variations of atmospheric conditions does not appear to significantly affect the value of the mean flux density of meteor bodies and the matter influx onto the Earth. Author

**N88-14546*#** Moscow Physical-Engineering Inst. (USSR).
**METEOR VELOCITY DISTRIBUTION AND AN OPTIMUM MONITORING MATHEMATICAL MODEL** **c90**
N. G. Volkov and O. N. Salimov *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 316-320 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

At present, there are a great number of radio meteor, ionosphere and rocket observation data for the altitude range of 80 to 100 km which indicate the existence of large scale circulation systems in the mesopause to low thermosphere range which change regularly with season and latitude. But the existing observation network and observation programs are not optimal for revealing the main factors forming the circulation mode at these altitudes. A generalized optimum monitoring mathematical model is offered for consideration. The model input data are distribution density, response function, individual measurement root mean square uncertainty and detection effectiveness function. The model makes it possible to obtain the observation distribution density, the minimal possible dispersion and optimized system effectiveness. Author

**N88-14547*#** Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
**THE VALEC FIREBALL AND PREDICTED METEORITE FALL** **c90**
Z. Ceplecha and P. Spurny *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 321-328 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

A fireball was photographed with a luminous trajectory below a height of 20 km. On Aug. 3, 1984, seven stations photographed this slow moving fireball, which traversed 94 km of luminous trajectory in 9.2 sec and terminated its visible flight at a height of 19.1 km. The computed dark flight trajectory intersected the surface close to Valec, a small village 40 km west of Brno. The Valec fireball was the lowest photographed fireball ever. The Valec fireball was photographed by fish eye cameras. The positional precision of all the records were within the range of 1 to 2 minutes of arc. All computations were done using the FIRBAL program, a set of almost 4000 Fortran statements run on EC 1040 computer. The average computed mass at the terminal point, i.e., the predicted mass of the biggest meteorite, was 16 kg. This number is based on the dynamical data at the terminal point solely. Visual data was also collected from occasional observers. This observed phenomenon is discussed. Author

**N88-14548*#** Slovak Academy of Sciences, Bratislava (Czechoslovakia). Astronomical Inst.
**RESULTS OF OBSERVATIONS OF THE ETA AQUARID AND ORIONID METEOR SHOWERS IN 1980-1984** **c90**
A. Hajduk *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 329-335 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

The main characteristics of meteor showers associated with Comet Halley were derived from the most recent radar observations carried out at the Ondrejov Astronomical Observatory during the periods of May 1 to 10 and October 15 to 30. The activity variations, the positions of activity maxima, the size distribution of particles, the particle flux variation within the stream and other characteristics were determined and compared with other results. Author

**N88-14549*#** Moscow Physical-Engineering Inst. (USSR).
**MONTE CARLO MODELING AND METEOR SHOWERS** **c90**
N. V. Kulikova *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 336-338 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

Prediction of short lived increases in the cosmic dust influx, the concentration in lower thermosphere of atoms and ions of meteor origin and the determination of the frequency of micrometeor impacts on spacecraft are all of scientific and practical interest and all require adequate models of meteor showers at an early stage of their existence. A Monte Carlo model of meteor matter ejection from a parent body at any point of space was worked out by other researchers. This scheme is described. According to the scheme, the formation of ten well known meteor streams was simulated and the possibility of genetic affinity of each of them with the most probable parent comet was analyzed. Some of the results are presented. Author

**N88-14550*#** Academy of Sciences of the Tajik SSR, Doushanbe.
**ON THE SPATIAL STRUCTURE OF THE PERSEIDS METEOR STREAM** **c90**
G. V. Andreev, L. N. Rubtsov, and I. I. Tarasova *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 339-343 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

The analysis of radar observations of the Perseid meteor stream conducted in an ionospherical laboratory in the period from 1964 to 1981 is presented. The Perseids meteor rates were determined by the fluctuation method. Analysis of their hourly distributions showed that the stream maximum position is different for different years, i.e., the stream nodal position is constantly changing. The results of the analysis are presented and discussed. Author

**N88-14551*#** Kazan State Univ. (USSR).
**SOME MODELS OF THE GEMINIDS METEOR STREAM FORMATION** **c90**
O. I. Belkovich and G. O. Ryabova *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 344-350 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

Further development of methods of investigations of meteor shower structure and a great deal of observational data have made it possible to obtain a precise flux density profile along the Earth's orbit for the Geminids meteor shower. This curve proved to be adequately described by a exponential law. Examined are: (1) which ejection model will fit the observed shower structure; and (2) to what extent the subsequent process of evolution modifies the formed structure. The following conclusions are drawn: (1) When studying the mechanism of formation of meteor streams, it is necessary to take into consideration the velocity distribution of particles that have been ejected from the parent body; (2) On the basis of the observed density variations, it is possible to determine what kind of ejection takes place (a single ejection or that around an orbital arch); and (3) The original structure of the Geminids cross section persists for no more than 1,500 to 2,000 years. Author

**N88-14552*#** Academy of Sciences of the Tajik SSR, Doushanbe.
**STRUCTURAL PECULIARITIES OF THE QUADRANTID METEOR SHOWER** **c90**
SH. O. Isamutdinov and R. P. Chebotarev *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 351-355 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

Systematic radio observations to investigate the Quadrantid meteor shower structure are regularly carried out. They have now been conducted annually in the period of its maximum activity, January 1 to 6, since 1966. The latest results of these investigations are presented, on the basis of 1981 to 1984 data obtained using new equipment with a limiting sensitivity of +7.7 sup m which make it possible to draw some conclusions on the Quadrantids shower structure both for transverse and lengthwise directions. Author

**N88-14553*#** Kiev State Univ. (USSR).
**ON THE POSSIBLE ORIGIN OF METEOROID GENERATING ASTEROID ORBITS** **c90**
A. M. Kazantsev and L. M. Sherbaum *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 356-360 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

A mechanism to replenish the Apollo and Amor groups by resonant asteroid-orbit transformation is suggested. The method of this mechanism and the results obtained are discussed. Author

**N88-14554*#** Colorado Univ., Boulder.
**METEOR DETECTION ON ST (MST) RADARS** **c90**
S. K. Avery *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 361-375 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

The ability to detect radar echoes from backscatter due to turbulent irregularities of the radio refractive index in the clear atmosphere has lead to an increasing number of established mesosphere - stratosphere - troposphere (MST or ST) radars. Humidity and temperature variations are responsible for the echo in the troposphere and stratosphere and turbulence acting on electron density gradients provides the echo in the mesosphere. The MST radar and its smaller version, the ST radar, are pulsed Doppler radars operating in the VHF - UHF frequency range. These echoes can be used to determine upper atmosphere winds at little extra cost to the ST radar configuration. In addition, the meteor echoes can supplement mesospheric data from an MST radar. The detection techniques required on the ST radar for delineating meteor echo returns are described. Author

**N88-14555*#** Institute of Experimental Meteorology, Obninsk (USSR).
**THE CYCLONE METEOR RADAR SYSTEM FOR ROUTINE WIND MEASUREMENTS IN THE LOWER THERMOSPHERE** **c32**
I. A. Lysenko, P. P. Mikhailiek, and B. I. Petrov *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 376-380 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 17I

A new meteor wind radar system called Cyclone was devised to extend and update the meteor radar network and for unattended operation. The Cyclone meteor radar system obtains information from four directions simultaneously. To automate data processing a special digital device was developed. An algorithm used to determine the Doppler shifts was adopted, which makes it possible to eliminate selectivity with respect to slow velocity meteor drifts. The operation of the Cyclone system is described. Author

**N88-14556*#** Newcastle Univ. (Australia).
**THE NEWCASTLE METEOR RADAR** **c32**
Colin Keay *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 381-388 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 17I

A brief history and development of the Newcastle Meteor Radar system is given. Also described are its geographical coordinates and its method of operation. The initial objective when the project was commenced was to develop an entirely digital analyzer capable of recognizing meteor echo signals and recording as many of their parameters as possible. This objective was achieved. E.R.

**N88-14557*#** State Univ. of New York, Geneseo. Dept. of Physics and Astronomy.
**NEW APPROACHES TO SOME METHODOLOGICAL PROBLEMS OF METEOR SCIENCE** **c90**
David D. Meisel *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 389-404 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

Several low cost approaches to continuous radioscatter monitoring of the incoming meteor flux are described. Preliminary experiments were attempted using standard time frequency stations WWVH and CHU (on frequencies near 15 MHz) during nighttime hours. Around-the-clock monitoring using the international standard aeronautical beacon frequency of 75 MHz was also attempted. The techniques are simple and can be managed routinely by amateur astronomers with relatively little technical expertise. Time series analysis can now be performed using relatively inexpensive microcomputers. Several algorithmic approaches to the analysis of meteor rates are discussed. Methods of obtaining optimal filter predictions of future meteor flux are also discussed. Author

**N88-14558*#** Academy of Sciences (USSR), Ashkhabad.
**LIDAR INVESTIGATIONS OF M-ZONE** **c36**
O. G. Ovezgeldiyev, K. Kurbanmuradov, M. F. Lagutin, A. A. Zarudny, Yu. E. Meghel, A. A. Torba, and V. E. Melnikov (Kharkovskii Inst. Radioelektroniki, USSR ) *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 405-409 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 20E

The creation of pulse dye lasers tuned to resonant line of meteor produced admixtures of atmospheric constituents has made it possible to begin lidar investigations of the vertical distribution of mesospheric sodium concentration and its dynamics in the upper atmosphere. The observed morning increase of sodium concentration in the vertical column is probably caused by diurnal variations of sporadic meteors. The study of the dynamics of the sodium column concentration in the period of meteor streams activity confirms the suggestion of cosmic origin of these atoms. The short lived increase of sodium concentration brought about by a meteor stream, however, exceeds by one order the level of the sporadic background. Author

**N88-14559*#** Academy of Sciences (USSR), Ashkhabad. Inst. of Physical Technology.
**OPTICAL ELECTRONICS FOR METEOR OBSERVATIONS** **c89**
R. I. Shafiev, S. Mukhamednazarov, and I. A. Atamas *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 410-415 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03A

Spectral observations of meteors have been carried out for several years using an optical electronics facility. Interest has centered on faint meteors and their trails in the period of intensive meteor showers. Over 800 meteors were registered during the observation period, with spectrograms obtained for 170 of these. A total of 86 meteors were photographed from two sites and for 25 of these spectrograms of the meteors as well as their trails were obtained. All meteors have undergone routine processing in order to determine atmospheric characteristics. Results are discussed. Author

**N88-14560*#** Academy of Sciences (USSR), Ashkhabad. Inst. of Physical Technology.
**HARD- AND SOFTWARE PROBLEMS OF SPACED METEOR OBSERVATIONS BY OPTICAL ELECTRONICS** **c74**
R. I. Shafiev, S. Mukhamednazarov, and A. Sh. Ataev *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 416-420 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 20F

An optical electronic facility is being used for meteor observations along with meteor radars and astronomical TV. The main parts of the facility are cameras using UM-92 optical electronic image tubes. The three cascade optical electronic image tube with magnetic focusing has a 40 mm cathode and resolution in the center of up to 30 pairs of lines/mm. The photocathode is of a multislit S-20 type. For meteor spectra observations, replica gratings of 200 and 300 lines/mm are used as the dispersive element. Author

**N88-14561#** Service Hydrographique et Oceanographique de la Marine, Brest (France). Section Geodesie-Geophysique.
**EVALUATION OF A MODEL OF THE EARTH'S GRAVITY FIELD**
A. Fourgassie 8 Apr. 1987 37 p In FRENCH
Sponsored by Direction des Recherches, Etudes et Techniques, Paris, France
(PB87-217436; EPSHOM/E/GG/NP-265; EPSHOM-003/87)
Avail: NTIS HC E04/MF E04 CSCL 08G

Anticipating the increasing demand for ocean locations, the Technical Service of Construction and Navy Weapons has proceeded together with the National Center for Space Studies (CNES) to study the field of the Earth's gravity towards an accurate determination. The EPSHOM has proceeded to the evaluation of the model set up by the CNES through conparison with gravimetric oceanic surveys. The methods and results of the analysis are presented here. GRA

**N88-14562** Cornell Univ., New York, N.Y.
**OBSERVATIONS OF INERTIAL PERIOD WAVES AND VERTICAL VELOCITIES IN THE TROPICAL MIDDLE ATMOSPHERE USING THE MST RADAR TECHNIQUE Ph.D. Thesis**
Charles Robert Cornish 1987 234 p
Avail: Univ. Microfilms Order No. DA8715610

The UHF radar at Arecibo, Puerto Rico, and the VHF radar at Jicamarca, Peru were used as Mesospheric-Stratospheric-Tropospheric (MST) radar wind profilers to observe wind and waves in the tropical middle atmosphere. Spectral analysis of the 1982 velocity data reveals the presence of two inertia-gravity wave modes, with intrinsic periods of 19 and 20 hours and observed periods of 26 and 54 hours. The presence of inertial oscillations are inferred. These observations confirm previous reports of discrete inertial wave events but suggest the occurence of several simultaneous wave modes. Uncertainties in the measurements raise questions whether wave disappearance at upper levels is physical or instrumental. Measurements of vertical velocities with the Arecibo UHF radar compare well with the VHF radar measurements of vertical velocites made elsewhere and show the occurrence of short-period gravity waves and buoyancy oscillations in the upper troposphere and lower stratosphere. Backscattered Doppler measurements at Jicamarca from the 15 to 90 km region indicate the VHF radars can make velocity measurements through the entire middle atmosphere if the radar power aperture product is suficient. Dissert. Abstr.

**N88-14563** California Univ., Los Angeles.
**RADAR OBSERVATIONS OF HIGH-LATITUDE LOWER-THERMOSPHERIC AND UPPER-MESOPHERIC WINDS AND THEIR RESPONSE TO GEOMAGNETIC ACTIVITY Ph.D. Thesis**
Roberta Marie Johnson 1987 366 p
Avail: Univ. Microfilms Order No. DA8719948

Observations made by the Chatanika, Alaska incoherent scatter radar during the summer months of 1976 to 1981 are analyzed to obtain high resolution lower-thermospheric neutral winds. Average winds and their tidal components are presented and compared to previous observational and model results. The winds are dominated by strong semi-diurnal fluctuations, although diurnal oscillations are also present. Neutral winds for three different levels of geomagnetic activity are compared with the Thermospheric General Circulation Model (TGCM) results for three different steady-state levels of magnetospheric forcing. During geomagnetically active intervals, neutral winds above 100 km develop an enhanced zonal component in the morning sector, in agreement with TGCM predictions. Upper-mesospheric neutral winds made during two energetic Solar Proton Events are also presented.
Dissert. Abstr.

**N88-14564** Wisconsin Univ., Madison.
**MODES OF SURFACE CIRCULATION AND CLIMATE OVER THE TROPICAL ATLANTIC, EASTERN PACIFIC, AND INDIAN OCEANS Ph.D. Thesis**
Klaus (Eduard) Wolter 1987 183 p
Avail: Univ. Microfilms Order No. DA8714757

The investigation is devoted to the parsimonious description and diagnostic understanding of large-scale climate variations in the tropics. The role and importance of the Southern Oscillation over the Atlantic, Eastern Pacific, and Indian Oceans are analyzed as compared to other circulation modes that contribute to the interannual climate variability of the region in January/February and July/August. Factor analysis experiments are used to determine independent, internally consistent modes of the tropical ocean-atmosphere system. The Southern Oscillation is confirmed as the most important circulation mode. Dissert. Abstr.

**N88-14565*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**A CRITICAL REVIEW OF MEASUREMENTS OF WATER VAPOR ABSORPTION IN THE 840 TO 1100 cm(-1) SPECTRAL REGION**
William B. Grant 15 Dec. 1987 31 p Sponsored in part by the Department of the Air Force
(Contract NAS7-918)
(NASA-CR-182361; JPL-Pub-87-34; NAS 1.26:182361) Avail: NTIS HC A03/MF A01 CSCL 04A

A set of eleven measurements of the water vapor continuum absorption in the 840 to 1100 sq cm spectral region is reviewed and compared with spectral models maintained by the Air Force Geophysics Laboratory. The measurements were made in four different ways: spectrometer with a White cell, CO2 laser with a White cell, CO2 laser with a spectrophone, and broadband radiation source over a long atmospheric path. Where possible, the data were selected at a water vapor partial pressure of ten torr buffered to 760 torr with N2 or synthetic air and a temperature of between 296 and 300 K. The intercomparison of the data leads to several observations and conclusions. First, there are four sets of laboratory data taken with nitrogen as the buffer gas which generally agree well mutually and with AFGL's HITRAN code. Second, there is one set of laboratory data that shows that using air as the buffer gas gives a few percent decrease in the water vapor continuum compared with using nitrogen as the buffer gas. Third, the atmospheric long-path measurements for water vapor partial pressure below about 12 torr are roughly grouped within 20 percent of the HITRAN values. Fourth, there are three sets of spectrophone data for water vapor in synthetic air which are significantly higher than any of the other measurements. This discrepancy is attributed to the effects of impurity gases in the cell. Author

**N88-14566#** Institut d'Aeronomie Spatiale de Belgique, Brussels.
**LATITUDE COVERAGE OF OBSERVATIONS OF THE MIDDLE ATMOSPHERE BY SOLAR ABSORPTION SPECTROMETRY FROM A HELIOSYNCHRONOUS ORBIT**
J. Vercheval 1987 20 p Submitted for publication
(Aeronomica-Acta-A-316-1987; ISSN-0065-3713; ETN-88-90728)
Avail: NTIS HC A03/MF A01

The conditions in which atmospheric measurements by solar absorption spectrometry could be performed from a space platform in heliosynchronous orbit were analyzed. It is shown that the measurements have an annual coverage in latitude which depends on the mean local time at the ascending node of the orbit. The high latitude regions in both hemispheres are investigated. The coverage is extended to the equatorial region for mean local times at the ascending node close to 4, 8, 16, and 20 hr. It is also for these cases that the equation of time plays a major role. ESA

**N88-14567#** World Climate Programme, Geneva (Switzerland).
**REPORT OF THE JOINT SCIENTIFIC COMMITEE AD HOC WORKING GROUP ON RADIATIVE FLUX MEASUREMENTS**
Mar. 1987 87 p Prepared in cooperation with the International Council of Scientific Unions, Rome, Italy
(WCP-136; WMO/TD-76; ETN-88-90772) Avail: NTIS MF A01; print copy available from WMO, Geneva, Switzerland

A strategy for studying radiation flux as part of the World Climate Research Program is outlined. Key elements are the Earth radiation budget at the top of the atmosphere; solar irradiance; and the surface radiation budget. ESA

**N88-14568#** Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
**CURVATURE DRIVEN DRIFT MIRROR INSTABILITY IN THE MAGNETOSPHERE**
E. Amata, J. Woch, G. Kremser, A. Korth, O. A. Pokhotelov, V. A. Pilipenko, and Yu. M. Nezlina (Academy of Sciences, USSR, Moscow ) Dec. 1986 39 p
(Contract DFVLR-PT-RV/4-B12/73-(WRK-243))
(IFSI-86-14; ETN-88-91285) Avail: NTIS HC A03/MF A01

The resonant interaction between low frequency waves and magnetospheric plasma particles is examined for the case of field aligned phase velocity much less than the Alfven velocity. The coupling of compressional Alfven and drift mirror modes is obtained by including the field curvature effect. The field curvature is also responsible for an instability of the coupled mode similar to the

drift mirror instability (DM). However, this instability is started for a lower value of the anisotropy than in the case of DM. The comparison of theoretical predictions with storm time Pc-5 pulsations shows that many features of observed data can be reasonably explained in terms of the developed theory. ESA

**N88-14569#** Technische Hogeschool, Eindhoven (Netherlands). Lab. of Fluid Dynamics and Heat Transfer.
**A METHOD TO OBTAIN A WIND MODEL FOR THE BOUNDARY LAYER IN A REPRESENTATIVE TROPICAL REGION**
E. H. AbuBakr, M. Rutten, P. T. Smulders, G. Vossers, and J. Wieringa Oct. 1986 7 p Presented at the 6th European Wind Energy Conference, Rome, Italy, Oct. 1986 Sponsored by the Netherlands Foundation for the Advancement of Tropical Research
(R-818-D; ETN-88-91313) Avail: NTIS HC A02/MF A01

Construction of a reference data base, for developing a boundary layer model for tropical regions is described. An area of 20,000 sqkm around Khartoum (Sudan) was selected. The assembled surface wind data are corrected for exposure, and their reliability is checked. It is shown that due to the seasonal influence of the intertropical convergence zone any full year representation of wind frequency distribution is misleading and that seasonal analysis is required. The average wind profile to 2 km height shows a jet-like appearance, which invalidates the use of simple relations between large-scale free atmospheric wind and surface wind climate. It is shown that for the winter season an Ekman wind profile with thermal wind modification might prove useful. ESA

**N88-14570#** RADEX, Inc., Carlisle, Mass.
**INTEGRATED SYSTEMS WITH APPLICATIONS TO THE MULTI-PHASES OF THE EPHEMERIDES, PHYSICS AND METHEMATICS OF THE UPPER ATMOSPHERE Final Report, Jun. 1983 - Feb. 1987**
J. N. Bass, K. H. Bhavnani, N. A. Bonito, C. M. Bryant, Jr., and W. J. McNeil 27 Feb. 1987 231 p
(Contract F19628-83-C-0134)
(AD-A185748; RX-870227; AFGL-TR-87-0064) Avail: NTIS HC A11/MF A01 CSCL 04A

This contract provided research, analysis and development support for integrated systems with applications to ephemerides, physics, and mathematics of the upper atmosphere. Investigations have been supported in various aspects of neutral atmospheric density, ionospheric scintillation, magnetic field models, magnetospherically trapped particles and auroral particle precipitation. Software systems have been developed for processing and analyzing data pertaining to these research areas, and for interactive targeting of the space shuttle, ephemeris computation during double thrust, and processing of celestial aspect sensor data. GRA

**N88-14571#** Texas Univ., Dallas. Richardson Center for Space Sciences.
**GLOBAL CONVECTION PATTERNS IN THE HIGH LATITUDE Final Technical Report, 4 Mar. 1983 - 31 Dec. 1986**
R. A. Heelis Feb. 1987 23 p
(Contract F19628-83-K-0022)
(AD-A185794; AFGL-TR-87-0131) Avail: NTIS HC A03/MF A01 CSCL 04A

Studies of large and small scale structures in the high latitude F-region plasma velocity and concentration have been undertaken. The large-scale plasma convection pattern has been examined using an extensive satellite data base to reveal a major dependence of the dayside configuration of the pattern on the y-component of the interplanetary magnetic field. A model has been constructed for periods of southward IMF much smaller scale structure is seen to dominate the observations. A smaller scale convection pattern has been tentatively identified in the data for northward IMF. Of primary importance, however, is the existence of small scale structure associated with sun-aligned arcs that have dimensions in the noon-midnight-direction that exceed those in the dawn-dusk direction by a factor of 10. In addition to these properties of the convection pattern the formation of E region structure by the presence of structure in the F region has also been examined. GRA

**N88-14244#** Oulu Univ. (Finland). Dept. of Physics.
**EISCAT RESEARCH PROGRAMS FOR 1987 [EISCAT-TUTKIMUKSEN TAVOITTEET V. 1987]**
Jorma Kangas *In its* Report of the 3rd Finnish EISCAT Workshop Mar. 1987 p 91-92 In FINNISH (For primary document see N88-14233 06-32)
Avail: NTIS HC A05/MF A01

**N88-14467#** Joint Publications Research Service, Arlington, Va.
**INFLUENCE OF GAS EXCHANGE BETWEEN OCEAN AND ATMOSPHERE ON FORMATION OF ATMOSPHERIC PRESSURE FIELD Abstract Only**
I. P. Semiletov *In its* USSR Report: Earth Sciences 22 May 1987 p 32 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 291, no. 5, Dec. 1986 p 1231-1234 Original language document was announced in IAA as A87-29793 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14479#** Joint Publications Research Service, Arlington, Va.
**EFFECTIVE METHODS OF GRAVIMETRIC AND MAGNETOMETRIC DATA PROCESSING Abstract Only**
S. M. Oganesyan, A. G. Manukyan, and M. G. Oganesyan *In its* USSR Report: Earth Sciences 22 May 1987 p 85 Transl. into ENGLISH from Izvestiya Akademii Nauk Armlyanskoy SSR: Nauki o Zemle (Yerevan, USSR), v. 39, no. 5, Sep. - Oct. 1986 p 35-39 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14480#** Joint Publications Research Service, Arlington, Va.
**POLAR GEOPHYSICAL INSTITUTE'S STUDIES OF MAGNETOSPHERE, IONOSPHERE Abstract Only**
*In its* USSR Report: Earth Sciences 22 May 1987 p 96 Transl. into ENGLISH from NTR: Problemy i Resheniya (USSR), 4-17 Nov. 1986 p 5 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14743#** Joint Publications Research Service, Arlington, Va.
**NONUNIFORMITY OF ELECTROMAGNETIC FIELD AT LAMBDA = 10.6 MICRON WAVELENGTH INSIDE ATMOSPHERIC AEROSOL PARTICLES Abstract Only**
N. N. Belov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 33 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 61, no. 6, Dec. 1986 p 1331-1336 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14878*#** Sul Ross State Univ., Alpine, Tex. Dept. of Geology.
**PETROGENESIS OF BASALTS FROM THE ARCHEAN MATACHEWAN DIKE SWARM SUPERIOR PROVINCE OF CANADA Final Report**
Dennis O. Nelson *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 20 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 08G

**N88-14879*#** Sul Ross State Univ., Alpine, Tex. Analytical Lab.
**MID-TERTIARY VOLCANO-TECTONIC DEVELOPMENT OF THE SOUTHWESTERN CORDILLERA OF NORTH AMERICA Final Report**
Kerri L. Nelson *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 19 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 19 p (SEE N88-14874

06-85)
Avail: NTIS HC A15/MF A01 CSCL 08G

# 47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

**N88-14572*** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**DESCRIPTION OF DATA ON THE NIMBUS 7 LIMS MAP ARCHIVE TAPE. PART 3: WATER VAPOR AND NITROGEN DIOXIDE**
Kenneth V. Haggard, B. T. Marshall, Robert J. Kurzeja (Du Pont de Nemours, E. I. and Co., Aiken, S.C ), Ellis E. Remsberg, and James M. Russell, III Feb. 1988 69 p
(NASA-TP-2761; L-16313; NAS 1.60:2761) Avail: NTIS HC A04/MF A01 CSCL 04B

Described is the process by which the analysis of the Limb Infrared Monitor of the Stratosphere (LIMS) experiment data were used to produce estimates of synoptic maps of water vapor and nitrogen dioxide. In addition to a detailed description of the analysis procedure, also discussed are several interesting features in the data which are used to demonstrate how the analysis procedure produced the final maps and how one can estimate the uncertainties in the maps. In addition, features in the analysis are noted that would influence how one might use, or interpret, the results. These include subjects such as smoothing and the interpretation of wave components. Author

**N88-14573#** Lawrence Livermore National Lab., Calif.
**INTERPRETATION OF OUR PRESENT TERRESTRIAL CLIMATIC RECORD**
H. W. Elisaesser Sep. 1987 14 p Presented at the Workshop on Monitoring Climate, Fort Collins, Colo., 26 Aug. 1987
(Contract W-7405-eng-48)
(DE88-000223; UCRL-97354; CONF-8708146-1) Avail: NTIS HC A03/MF A01

Detailed studies of profiles of delta O-18 in oceanic and glacial cores and of pollen deposits in bogs indicate that the terrestrial climatic system, consisting of the atmosphere, hydrosphere, lithosphere and biosphere, is capable of oscillations with amplitudes, such as that of the Melisey II stadial of northern France, approaching or equaling that of the glacial-interglacial cycle but on time scales too short for the usually envisioned transfer of mass between the oceans and continental glaciers. Abrupt oscillations or shifts to new equilibrium are well documented in the Boelling-Aleroed warming and Younger Dryas readvance, the 0.4 C rise in NH continental air temperature circa 1920 and the year-to-year oscillations in NH continental air temperatures from 1976 to 1984. Such abrupt oscillations defy explanation in terms of external forcing functions and suggest rather internal rearrangements within the climate system as the driving mechanism. Suggestions are made as to mechanisms for possible internal rearrangements which might lead to different hemispheric or global mean surface temperatures. DOE

**N88-14574#** Department of Energy, Washington, D. C.
**CARBON DIOXIDE AND CLIMATE: SUMMARIES OF RESEARCH IN FY 1987**
Oct. 1987 95 p
(DE88-000916; DOE/ER-0347) Avail: NTIS HC A05/MF A01

This report describes the activities and products of the Carbon Dioxide Research (CDR) Program in fiscal year 1987. Project descriptions are categorized according to program areas: energy systems, climate systems, agro-ecosystems, resource analysis, scientific interface, and integration and evaluation. DOE

**N88-14575*#** Universities Space Research Association, Huntsville, Ala.
**ATMOSPHERIC ELECTRICITY Final Report, 28 May 1982 - 21 Oct. 1987**
23 Dec. 1987 7 p
(Contract NAS8-34748)
(NASA-CR-179239; NAS 1.26:179239) Avail: NTIS HC A02/MF A01 CSCL 04B

In the last three years the focus was on the information contained in the lightning measurement, which is independent of other meteorological measurements that can be made from space. The characteristics of lightning activity in mesoscale convective systems were quantified. A strong relationship was found between lightning activity and surface rainfall. It is shown that lightning provides a precursor signature for wet microbursts (the strong downdrafts that produce windshears hazardous to aircraft) and that the lightning signature is a direct consequence of storm evolution. The Universities Space Research Association (USRA) collaborated with NASA scientists in the preliminary analysis and scientific justification for the design and deployment of an optical instrument which can detect lightning from geostationary orbit. Science proposals for the NASA mesoscale science program and for the Tethered Satellite System were reviewed. The weather forecasting research and unmanned space vehicles. Software was written to ingest and analyze the lightning ground strike data on the MSFC McIDAS system. The capabilities which were developed have a wide application to a number of problems associated with the operational impacts of electrical discharge within the atmosphere. B.G.

**N88-14576** Clemson Univ., S.C.
**RADAR OBSERVATIONS OF CHANGES IN PRECIPITATION SIZE SPECTRA ASSOCIATED WITH LIGHTNING Ph.D. Thesis**
Daniel Norman Holden 1987 103 p
Avail: Univ. Microfilms Order No. DA8719214

Observations of thunderstorms were made in the summer of 1985 with the 430 MHz and 50 MHz Doppler radars in Puerto Rico. Shapes of the Doppler spectra were observed to change with the occurrence of a lightning discharge in the pulse volume. Though the total returned power and reflectivity weighted Doppler velocity changed little, the spectral power at Doppler velocities near that corresponding to the updraft did increase substantially within a fraction of a second after the discharge was detected in the beam. The discharge plasma was assumed to move with the wind exactly. Therefore, the Doppler velocity of the lightning echo was used as a measure of the updraft velocity. From Doppler spectra and updraft velocity, particle size distributions and integral parameters of those distributions were calculated. Changes in the shape of the distribution and consequent changes in integral parameters were observed to occur coincident with lightning.
Dissert. Abstr.

**N88-14577** Wisconsin Univ., Madison.
**ESTIMATION OF RAINFALL RATES IN TROPICAL CYCLONES BY PASSIVE MICROWAVE RADIOMETRY Ph.D. Thesis**
William Stuart Olson 1987 312 p
Avail: Univ. Microfilms Order No. DA8714742

A numerical model was developed to study the transfer of microwave radiation (6.6 to 37 GHz) through a plane-parallel cloud of hydrometeors. The effects of multiple scattering within the cloud, as well as polarization by the underlying Earth's surface are considered in this formulation. Model parameters characteristic of tropical cyclone rain cells over the ocean are specified, and the resulting microwave intensities emerging from the cloud tops are calculated. Dissert. Abstr.

**N88-14578*#** Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
**AN EARTH RADIATION BUDGET CLIMATE MODEL Final Report**
Fred L. Bartman Jan. 1988 60 p
(Grant NAG1-539)
(NASA-CR-182368; NAS 1.26:182368) Avail: NTIS HC A04/MF A01 CSCL 04B

A 2-D Earth Radiation Budget Climate Model has been constructed from an OLWR (Outgoing Longwave Radiation) model and an Earth albedo model. Each of these models uses the same cloud cover climatology modified by a factor GLCLC which adjusts

the global annual average cloud cover. The two models are linked by a set of equations which relate the cloud albedos to the cloud top temperatures of the OLWR model. These equations are derived from simultaneous narrow band satellite measurements of cloud top temperature and albedo. Initial results include global annual average values of albedo and latitude/longitude radiation for 45 percent and 57 percent global annual average cloud cover and two different forms of the cloud albedo-cloud top temperature equations. Author

**N88-14579#** World Meteorological Organization, Geneva (Switzerland).
**REPORT OF THE SECOND SESSION OF THE CAS/JSC WORKING GROUP ON NUMERICAL EXPERIMENTATION**
1986 72 p Session presented to the Japan Meteorological Agency, Tokyo, Japan, 11-15 Aug. 1986 Prepared in cooperation with the International Council of Scientific Unions, Rome, Italy
(WMO/TD-168; ETN-88-90768) Avail: NTIS MF A01; print copy available from WMO, Geneva, Switzerland

Parameterization and representation of various effects in atmospheric models; ocean-atmosphere interaction; numerical weather forecasting and assessment of predictability; numerical experimentation and studies based on GARP data; and observing system and data assimilation were discussed. ESA

**N88-14580#** World Climate Programme, Geneva (Switzerland).
**REPORT OF THE SECOND SESSION OF THE WORKING GROUP ON SEA ICE AND CLIMATE**
Apr. 1987 104 p Session held in Seattle, Wash., 27-31 Oct. 1987 Prepared in cooperation with the International Council of Scientific Unions, Rome, Italy
(WCP-127; WMO/TD-127; ETN-88-90769) Avail: NTIS HC A01; print copy available from WMO, Geneva, Switzerland

Sea ice modeling; atmospheric forcing fields; ocean forcing; sea ice data for verification of climate models; southern hemisphere circulation of atmosphere, ocean, and sea ice; a project to study the Greenland Sea; and sea ice remote sensing were discussed. ESA

**N88-14581#** World Climate Programme, Geneva (Switzerland).
**REPORT OF THE INTERNATIONAL SATELLITE CLOUD CLIMATOLOGY PROJECT (ISCCP) WORKSHOP ON CLOUD ALGORITHMS IN THE POLAR REGIONS**
E. Raschke, comp. Mar. 1987 80 p Workshop held in Tokyo, Japan, 19-21 Aug. 1986 Prepared in cooperation with the International Council of Scientific Unions, Rome, Italy
(WCP-131; WMO/TD-170; ETN-88-90770) Avail: NTIS MF ; print copy available from WMO, Geneva, Switzerland

Spectral albedo of snow, ice and clouds; discrimination of polar clouds from AVHRR infrared multispectral data; a pattern analysis technique for classifying and analyzing surface and cloud types in the Arctic; sensitivity study on discrimination between cirrus clouds, aerosol layers, and snow surfaces over Arctic atmospheres; the clouds and NOAA-7 AVHRR split window; cloud analysis of AVHRR data measured over polar regions, and application of a cloud algorithm to satellite observations of the polar regions were discussed. ESA

**N88-14582#** World Climate Programme, Geneva (Switzerland).
**REPORT OF THE FIRST SESSION OF THE INTERNATIONAL WORKING GROUP ON DATA MANAGEMENT FOR THE GLOBAL PRECIPITATION CLIMATOLOGY PROJECT**
1986 51 p Session held in Washington, D.C., 12-14 Nov. 1986 Prepared in cooperation with the International Council of Scientific Unions, Rome, Italy
(WCP-132; WMO/TD-171; ETN-88-90771) Avail: NTIS MF A01; print copy available from WMO, Geneva, Switzerland

Events leading to the establishment of the Global Precipitation Climatology project were recalled. The polar data processing center; the polar satellite precipitation data processeing center; geostationary satellite data processing centers; and the implementation/data management plan were discussed. ESA

**N88-14583#** World Meteorological Organization, Geneva (Switzerland).
**THE GLOBAL CLIMATE SYSTEM: AUTUMN 1984 TO SPRING 1986**
S. Unninayar, C. Ropelewski, K. H. Bergman, J. Bruce, A. Chowdhury, G. A. Corby, M. Coughlan, H. Dronia, M. Gwynne, and P. D. Jones (East Anglia Univ., Norwich, England ) et al. 1987 85 p Prepared in cooperation with the United Nations Environment Program, Nairobi, Kenya, and the International Council of Scientific Unions, Rome, Italy In its World Climate Data Programme
(CSM-R84/86; ETN-88-90774) Copyright Avail: NTIS MF A01; print copy available from WMO, Geneva, Switzerland

The simplified planetary climate system; time scales of climate change; tropical-extratropical interactions; significant large-scale temperature and precipitation anomalies from autumn 1984 to spring 1986; the tropics and the subtropics; the extratropics; polar stratospheric sudden warming; greenhouse gases; CO2 and the annual cycle in photosynthetic production; the ozone hole; trends in snow cover, sea ice; air pollution, water quality and health; atmospheric angular momentum and Earth rotation changes; changes in solar radiation; and the geomagnetic jerk are discussed. ESA

**N88-14584#** World Meteorological Organization, Geneva (Switzerland).
**TROPICAL HYDROLOGY**
1987 77 p
(WMO-655; OH-25; ISBN-92-63-10655-X; ETN-88-90775)
Copyright Avail: NTIS MF A01; print copy available from WMO, Geneva, Switzerland SWFR 15

Similarities and differences between the methods and technology in operational hydrology applicable in tropical regions and those applicable in other areas are discussed. Problems in applying network design techniques to the humid tropics and in adapting available equipment and measuring techniques are reviewed. Data collection, processing, and dissemination are examined. The requirements for meteorological data on tropical cyclones needed for hydrological forecasts in areas prone to such cyclones are investigated. Forecasts of small and large rivers, including the flooding of tidal river reaches as a result of the combined effect of river flow and storm surge, are emphasized. ESA

**N88-14585#** World Meteorological Organization, Geneva (Switzerland).
**EIGHTH SESSION OF THE COMMISSION FOR AERONAUTICAL METEOROLOGY (ABRIDGED) Final Report**
1987 78 p Session held at Geneva, Switzerland, 4-14 Nov. 1986
(WMO-673; ISBN-92-63-10673-8; ETN-88-90776) Copyright Avail: NTIS MF A01; print copy available at WMO, Geneva, Switzerland

Meteorological observations and information distribution arrangements for local aeronautical users; provision of meteorological information required before and during flight; ammendments to WMO technical regulations; implementation of the world area forecast system; monitoring and quality control of observational data and forecasts; and international cooperation were discussed. ESA

**N88-14586#** National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
**ACQUISITION OF GUST STATISTICS FROM AIRCRAFT INTEGRATED DATA SYSTEMS (AIDS) RECORDED DATA**
J. B. deJonge, J. J. P. VanderWekken, and R. Noback 28 Jul. 1986 18 p Presented at the 63rd AGARD Structures and Materials Panel Meeting, Athens, Greece, Sep. 1986
(NLR-MP-86048-U-Iss-2; B8709828; ETN-88-91329) Avail: NTIS HC A03/MF A01

The procedures applied to reduce B-747 acceleration data from greater than 100,000 flight hours to derived gust velocities are described. The results are presented and compared with other

data sources. The validity of the assumptions made in the derivation are discussed. ESA

**N88-14587#** Royal Netherlands Meteorological Inst., De Bilt. Physical Meteorology Dept.
**FACILITIES FOR RESEARCH AND WEATHER OBSERVATIONS ON THE 213 M TOWER AT CABAUW (NETHERLANDS) AND AT REMOTE LOCATIONS**
W. A. W. Monna and J. G. vanderVliet 1987 33 p
(KNMI-WR-87-5; ISSN-0169-1651; ETN-88-91336) Copyright Avail: NTIS HC A03/MF A01

Instruments used to measure wind speed and direction, atmospheric temperature, humidity, visibility, radiation, soil heat flux, soil temperature, precipitation, mixing height, cloud-base height, and atmospheric pressure from a tower and mobile unit for boundary layer studies are described. Auxiliary equipment and the data systems are presented. ESA

**N88-14588#** National Climatic Center, Asheville, N. C.
**WAVE AND WIND DATA SOURCES, ENVIRONMENTAL CONDITIONS COMMITTEE REPORT, INTERNATIONAL SHIP AND OFFSHORE STRUCTURES CONGRESS**
R. G. Quayle 3 Sep. 1987 12 p
(PB87-234902) Avail: NTIS HC A03/MF A01 CSCL 04B

Some of the newer developments in wave and wind data are summarized. Major sources of data and information are listed. Primary sources of data and referral services are national oceanographic data centers, national meteorological services, the World Meteorological Organization, and the Marine Environmental Data Information Referral Catalogue published by the Intergovernmental Oceanographic Commission. Author

**N88-14589#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
**OBSERVATIONS OF A MIDLATITUDE SQUALL LINE BOUNDARY LAYER WAKE M.S. Thesis**
Paul Hamilton 1987 105 p
(AD-A185609; AFIT/CI/NR-87-45T) Avail: NTIS HC A06/MF A01 CSCL 04B

Mesoscale pressure perturbations frequently observed with mesoscale convective systems (MCS) are examined with special emphasis on the characteristics, structure, lifecycle and driving mechanism of the wake depression found in the wake region of the convection. A severe squall line which traversed the OK PRE-STORM surface and upper air mesonet-work on 10-11 June 1985 is the focus of this observational study. Extensive surface, upper air and digitized radar data collected during the OK PRE-STORM field experiment were used for analysis. Various mesoanalyses of this squall line at the surface and aloft have allowed for intensive examination of three pressure features observed with this squall line: the mesohigh wake depression and pre-squall mesolow. Their relationship to and interaction with other meteorological parameters such as precipitation, temperature, potential temperature and moisture are explored. Furthermore, the mesoscale system-relative jets observed with midlatitude squall lines are examined for their possible influence on the pressure field. GRA

**N88-14590#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
**THE EFFECT OF LATITUDE ON THE DEVELOPMENT OF TROPICAL CYCLONES M.S. Thesis**
John D. Pickle 1987 100 p
(AD-A185670; AFIT/CI/NR-87-95T) Avail: NTIS HC A05/MF A01 CSCL 04B

The three-layer balanced axisymmetric tropical cyclone model developed by Ooyama (1969) is generalized by relaxing the balance approximation and replacing the incompressible fluid layers with compressible fluid layers in isentropic coordinates. In numerical simulations the effects of latitude are non-linear; storms that intensify the fastest (at 100 deg N) do not intensify the most. When latitude is changed with other parameters held constant, storms between 20 and 30 deg N intensify the most. When the latitudinal change in sea surface temperature is considered, storms between 15 and 25 deg N intensify the most. The latter agrees with climatological trends observed in the western Pacific during 1980-1982. The effect of latitude is the dominant control of minimum surface pressure attained for lower latitudes (10 deg N ); whereas northward, the effects of latitude and sea surface temperature are dominant. The size of storms is largely dependent upon latitude, where larger storms occur at more northerly latitudes. Latitude influences the development of tropical cyclone growth by controlling the magnitude and radius of maximum updraft. At lower latitudes, the zone of maximum updraft occurs closer to the center of the storm producing aerially smaller storms, and the rate of heating is greater than for more northerly storms. Both factors, combined with the increased heating efficiency caused by higher inertial stability values, allow the storm to intensify rapidly. GRA

**N88-14591#** Naval Postgraduate School, Monterey, Calif.
**AUTOMATED SATELLITE CLOUD ANALYSIS: A MULTISPECTRAL APPROACH TO THE PROBLEM OF SNOW/CLOUD DISCRIMINATION M.S. Thesis**
Robert C. Allen, Jr. Jun. 1987 114 p
(AD-A185672) Avail: NTIS HC A06/MF A01 CSCL 04B

An algorithm is developed and evaluated for discriminating among clouds, snow cover and clear land. The multispectral technique uses daytime images of AVHRR channels 1 (0.63 microns, 3 (3.7 microns) and 4 (11.0 microns). Reflectance is derived for channel 3 by using the channel 4 emission temperature to estimate and remove the channel 3 thermal emission. Separation of clouds from snow and land is based primarily on this derived channel 3 reflectance. Using this technique, observed relectance in channel 3 is 2 to 4 percent for snow, 3 to 10 percent for land, 2 to 27 percent for ice clouds and 8 to 36 percent for liquid clouds. These values overlap for thin cirrus and snow, so the routine than attempts analysis of cirrus based on its different transmissive properties between channels 3 and 4. Six images were analyzed and the total cloud cover was verified against a total of 110 conventional surface observations using the standard categories of clear, scattered, broken and overcast. The routine was quite successful, with the analyzed sky cover being within category for 55 percent of the stations, one category different for 33 percent, 2 categories different for 9 percent and 3 categories for 3 percent of the stations. A major remaining problem is discrimination between ice clouds and snow cover due to the great similarity of reflective properties of there two surfaces. GRA

**N88-14592#** Naval Postgraduate School, Monterey, Calif.
**INTERIM REVIEW OF THE POSSIBILITIES AND OPPORTUNITIES FOR THE ONR TROPICAL CYCLONE MOTION RESEARCH INITIATIVE Interim Report, Oct. 1986 - Sep. 1987**
Russell L. Elsberry Sep. 1987 46 p
(AD-A185679; NPS-63-87-007) Avail: NTIS HC A03/MF A01 CSCL 04B

Expanded opportunities for theoretical studies of tropical cyclone motion are suggested in terms of more representative environmental structures and physical processes. Concurrent experimentation with state-of-the-art numerical models are recommended, especially for environmental conditions related to western North Pacific tropical cyclones. A review of existing observational data sets for testing hypotheses indicated that all satellite derived fields were already being studied. Thus a need exists for additional data sets, perhaps through deployment of recently developed dropwindsondes or of an array of wind profilers and the exploitation of satellite microwave imagers and sounders. Concerns regarding the feasibility of such a field experiment are related to lack of operational reconnaissance, availability of aircraft platforms for deploying the dropwindsondes and the need for international cooperation. The recommended mechanism to facilitate progress would be to establish a center for tropical cyclone motion studies. GRA

**N88-14593*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**HIGH-SPATIAL-RESOLUTION TOVS OBSERVATIONS FOR THE FIRE/SRB WISCONSIN EXPERIMENT REGION FROM OCTOBER 14 THROUGH NOVEMBER 2, 1986**
Charles H. Whitlock, Donald P. Wylie, and Stuart R. LeCroy (PRC Kentron, Inc., Hampton, Va.) Jan. 1988 181 p
(NASA-TM-100522; NAS 1.15:100522) Avail: NTIS HC A09/MF A01 CSCL 04B

Maps and concise tables are presented which show TOVS (TIROS Operational Vertical Sounder) HIRS/2 (High Resolution Infrared Sounder) data products, resolution size, and sounding location for the FIRE/SRB (First ISCCP Experiment/Surface Radiation Budget) Wisconsin experiment region from October 14 through November 2, 1986. The data presented are the result of a special analysis of the HIRS/2 sounder from the NOAA-9 and -10 satellites. Author

**N88-14594#** National Severe Storms Forecast Center, Kansas City, Mo.
**VERIFICATION OF SEVERE LOCAL STORM FORECASTS ISSUED BY THE NATIONAL SEVERE STORMS FORECAST CENTER, 1986 Final Technical Memo**
P. W. Leftwich Sep. 1987 17 p
(PB88-101407; NOAA-TM-NWS-NSSFC-18) Avail: NTIS HC A03/MF A01 CSCL 04B

The SELS unit of the National Severe Storms Forecast Center routinely issues convective outlooks and severe local storm watches to delineate areas favorable for development of severe local storms. The report summarizes verification of those forecasts issued during 1986. GRA

**N88-14456#** Joint Publications Research Service, Arlington, Va.
**AN-30M CLOUD-SEEDING AIRPLANE IN INTERNATIONAL EXHIBITION Abstract Only**
A. Pyrkov *In its* USSR Report: Earth Sciences 22 May 1987 p 2 Transl. into ENGLISH from Vozdushnyy Transport (Moscow, USSR), 6 Dec. 1986 p 4 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14457#** Joint Publications Research Service, Arlington, Va.
**REGIONAL WEATHER SATELLITE DATA PROCESSING CENTER OPENS IN TASHKENT Abstract Only**
V. Artemenko and Yu. Chernogayev *In its* USSR Report: Earth Sciences 22 May 1987 p 3 Transl. into ENGLISH from Pravda (Moscow, USSR), 7 Jan. 1987 p 6 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14458#** Joint Publications Research Service, Arlington, Va.
**BARS-1M METEOROLOGICAL COMPLEX CARRIED ON IL-18 AIRPLANE Abstract Only**
Aleksandr Ruvinskiy *In its* USSR Report: Earth Sciences 22 May 1987 p 4-5 Transl. into ENGLISH from Leninskoye Znamya (Leningrad, USSR), 24 Nov. 1986 p 4 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14459#** Joint Publications Research Service, Arlington, Va.
**CURRENT STATUS OF WORLD WEATHER SERVICE Abstract Only**
L. S. Dubrovina *In its* USSR Report: Earth Sciences 22 May 1987 p 7 Transl. into ENGLISH of Gidrometeorologiya: Seriya Meteorologiya, Sovremennoye Sostoyaniya Vsemirnoy Sluzhby Pogody (Obninsk, USSR), no. 7, 1986 p 1-36 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14460#** Joint Publications Research Service, Arlington, Va.
**NEW METHOD OF ESTIMATING CONTINENTALITY OF CLIMATE ON GLOBAL SCALE Abstract Only**
B. V. Poltaraus *In its* USSR Report: Earth Sciences 22 May 1987 p 8 Transl. into ENGLISH from Vestnik Moskovskogo Universiteta, Seriya 5: Geografiya (Moscow, USSR), no. 1, Jan. - Feb. 1986 p 64-72 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14506*#** Institute of Experimental Meteorology, Obninsk (USSR).
**THE CLIMATIC WIND REGIME IN THE LOWER THERMOSPHERE FROM METEOR RADAR OBSERVATIONS**
Yu. I. Portnyagin *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 31-44 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04B

# 48 OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources.

For related information see also *43 Earth Resources and Remote Sensing.*

**N88-14595#** Trondheim Univ. (Norway). Hydroteknisk Lab.
**FORECAST OF CURRENT PATTERNS FOR AN EDDY TRACKING EXPERIMENT IN THE NORWEGIAN COASTAL CURRENT**
T. A. McClimans 29 Dec. 1986 13 p Prepared in cooperation with Selskapet for Industriell og Teknisk Forskning, Trondheim, Norway
(PB87-224853; ISBN-82-595-4625-6; STF60-A86164) Avail: NTIS HC E03/MF E03 CSCL 08J

A 2 week forecast of the physical conditions in the Norwegian Coastal Current was made in Norwegian Hydrotechnical Laboratory's laboratory model of the northern North Sea. The model was previously calibrated and tested against measurements from 1982. The forecast is compared with a satellite thermal image one week into the future. A forecasted eddy was about 25 km to the north of an observed eddy, which appears to be due to a mismatch between the location of the laboratory source and the computed boundary conditions. A hindcast to determine the cause of observed discrepancies during the second week of the forecast is proposed. GRA

**N88-14596#** Institute of Oceanographic Sciences, Wormley (England).
**RRS DISCOVERY CRUISE 161, 15 AUGUST (227)-19 SEPTEMBER (262) 1986. PORTUGUESE OCEAN-CONTINENT BOUNDARY, PLATE BOUNDARIES WEST OF IBERIA AND SEISMIC STRUCTURE OF SEDIMENTS OFF MADEIRA**
R. B. Whitmarsh 1986 36 p
(PB87-222006; IOS/CRUISE-188) Avail: NTIS HC E04/MF E04 CSCL 08C

The cruise had three main objectives: to study the ocean-continent transition zone on the western margin of Portugal; to study the Azores-Gibraltar plate-boundary and past plate-boundaries of the Iberian plate; and to conduct experiments east of Madeira to characterize the seismic properties of the upper 1000m of sediment. The first objective was attained by the execution of a series of seismic refraction profiles, recorded by digital ocean-bottom seismographs (DOBS), and of reflection profiles which reached basement. The Azores-Gibraltar plate-boundary was studied using GLORIA, seismic reflection profiles, and a 7 day DOBS deployment close to the supposed boundary to attempt to record microearthquakes. Similar underway profiles were obtained further north in a search for fracture zones cutting anomaly 34, and older, crust. Lastly experiments were conducted with two DOBS at each of three sites about 130 degrees east of Madeira. GRA

**N88-14597#** Rome Univ. (Italy). Dipartimento di Fisica.
**PRELIMINARY REPORT OF HYDROLOGICAL MEASUREMENTS CARRIED OUT IN THE SOUTHERN ADRIATIC SEA: PALMA 86 CAMPAIGN [RAPPORTO PRELIMINARE SUI RISULTATI DELLE MISURE IDROLOGICHE ESEGUITE IN ADRIATICO MERIDIONALE: CAMPAGNA PALMA 86]**
Francesco Bignami, Nicola Conenna (Bari Univ., Italy ), Marco Ostili, Gabriella Palmieri, Barbara Palombo, Alessandra Rotundi, Silvia Schiarini, Enrico Sieni, and Enrico Zambianchi 23 Apr. 1987 81 p In ITALIAN
(Preprint-555; ETN-88-91268) Avail: NTIS HC A05/MF A01

The results of an oceanographic campaign carried out as part of the physical oceanography of the Eastern Mediterranean project are presented. The goal is the study of ocean circulation, its causes, and impact. The measurement system includes a CTD bathymeter, a Loran C system, and a data acquisition system based on Zilog Z80 microprocessor. ESA

**N88-14598#** Woods Hole Oceanographic Institution, Mass.
**PROGRESS IN THE MEASUREMENT OF SALINITY AND OXYGEN AT THE WOODS HOLE OCEANOGRAPHIC INSTITUTION**
G. P. Knapp and M. C. Stalcup Jan. 1987 31 p
(Grants NSF OCE-85-15642; NSF OCE-82-13967)
(PB88-108089; WHOI-87-4) Avail: NTIS HC A03/MF A01 CSCL 08C

Improvements in the measurement of salinity and dissolved oxygen during the past few years at WHOI have increased the accuracy of salinity observations to + or - 0.001 ppt and that of dissolved oxygen determinations to + or - 0.04 ml/l. These improvements are attributable to the careful maintenance of the sample collection and analysis equipment, the construction of portable, sea going laboratories in which the temperature is constant to + or - 1 C and the skillful use of an Autosal 8400-A salinometer and a Metrohm Titroprocessor by well trained technicians. An automated data logging system eliminates transcription errors and facilitates the timely calibration of the CTD sensors. Author

**N88-14599#** Arctec, Inc., Columbia, Md.
**NAVARIN BASIN ICE DRIFT PROGRAM Final Report, Mar. 1986 - Jan. 1987**
Jan. 1987 39 p
(Contract DTMA91-84-C-41032)
(PB88-104021; MA-RD-760-87048) Avail: NTIS HC A03/MF A01 CSCL 08C

Two drifting ice stations were specially designed and constructed by ARCTEC, Inc., consisting of a LORAN-C receiver, an ARCTEC Data Acquisition and Telemetry System (ARCDATS-1) and a GOES transmitter. The stations were deployed by ARCTEC, Inc. on March 20, 1986 in the Bering Sea in the vicinity of St. Lawrence Island using a Nome-based helicopter. The LORAN-C ice drift stations demonstrated good performance over the ARGOS system used the previous year. Under the sponsorship of PMEL, access to the GOES satellite was obtained. This proved to be a more reliable data transmission system than the previously used ARGOS system. GRA

**N88-14600#** National Oceanic and Atmospheric Administration, Seattle, Wash. Marine Environmental Lab.
**CTD/02 MEASUREMENTS DURING 1984 AND 1985 AS PART OF THE EQUATORIAL PACIFIC OCEAN CLIMATE STUDIES (EPOCS)**
L. J. Mangum, J. M. Lynch, and S. P. Hayes May 1987 343 p
(PB88-102082; NOAA-DR-ERL-PMEL-18; CONTRIB-968) Avail: NTIS HC A15/MF A01 CSCL 08J

During 1984 and 1985, CTD data were collected in the eastern equatorial Pacific as part of the Equatorial Pacific Ocean Climate Studies (EPOCS) program, which began its field program in 1979. Summaries of CTD data from four cruises in 1984 and 1985 are presented. Station locations, meteorological conditions and temperature profiles, salinity, sigma-T, and oxygen are shown for each cast. Additionally, T-S diagrams and section plots along 110 deg W, 140 deg W and the equator are presented. GRA

**N88-14462#** Joint Publications Research Service, Arlington, Va.
**TECTONICS OF THE CAROLINE OCEANIC STEP (SOUTHWESTERN PACIFIC OCEAN) Abstract Only**
Yu. M. Pushcharovskiy and Yu. N. Raznitsin *In its* USSR Report: Earth Sciences 22 May 1987 p 28 Transl. into ENGLISH from Geotektonika (Moscow, USSR), no. 6, Nov. - Dec. 1986 p 40-54 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14463#** Joint Publications Research Service, Arlington, Va.
**TECTONICS AND MAGMATISM OF WALVIS RIDGE AND DISCOVERY RISE (ATLANTIC OCEAN) Abstract Only**
B. P. Zolotarev and B. N. Kotenev *In its* USSR Report: Earth Sciences 22 May 1987 p 28-29 Transl. into ENGLISH from Geotektonika (Moscow, USSR), no. 6, Nov. - Dec. 1986 p 55-68 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14464#** Joint Publications Research Service, Arlington, Va.
**CONCENTRATION COEFFICIENTS OF ELEMENTS IN FERROMANGANESE NODULES RELATIVE TO OCEAN SEDIMENTS Abstract Only**
G. N. Baturin *In its* USSR Report: Earth Sciences 22 May 1987 p 29-30 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 291, no. 2, Nov. 1986 p 451-453 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14465#** Joint Publications Research Service, Arlington, Va.
**STATISTICAL STRUCTURE OF TEMPERATURE FIELD OVER SOUTH PACIFIC OCEAN Abstract Only**
V. A. Vasilyev, L. V. Vasilyeva, and A. V. Kondratyev *In its* USSR Report: Earth Sciences 22 May 1987 p 30 Transl. into ENGLISH from Vestnik Leningradskogo Universiteta, Seriya 7: Geologiya, Geografiya (Leningrad, USSR), no. 4, Dec. 1986 p 106-109 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14466#** Joint Publications Research Service, Arlington, Va.
**GEOPHYSICAL-GEOMORPHOLOGICAL STATISTICAL REGIONALIZATION OF NORTH ATLANTIC Abstract Only**
V. S. Mironov and V. G. Mishenkov *In its* USSR Report: Earth Sciences 22 May 1987 p 30 Transl. into ENGLISH from Vestnik Leningradskogo Universiteta, Seriya 7: Geologiya, Geografiya (Leningrad, USSR), no. 4, Dec. 1986 p 93-97 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14468#** Joint Publications Research Service, Arlington, Va.
**TECTONICS OF SEDIMENTARY COVER AND BASEMENT OF LABRADOR SEA Abstract Only**
K. A. Klitin *In its* USSR Report: Earth Sciences 22 May 1987 p 33 Transl. into ENGLISH from Byulleten Moskovskogo Obshchestva Ispytateley Prirody: Otdel Geologicheskiy (Moscow, USSR), v. 62, no. 1, Jan. - Feb. 1987 p 25-36 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14469#** Joint Publications Research Service, Arlington, Va.
**MATHEMATICAL-CARTOGRAPHIC MODELING OF ECONOMIC UTILIZATION OF ATLANTIC OCEAN Abstract Only**
Ye. A. Sigolayeva and V. S. Tikunov *In its* USSR Report: Earth Sciences 22 May 1987 p 36 Transl. into ENGLISH from Geografiya i Prirodnyye Resursy (Novosibirsk, USSR), no. 4, Oct. - Dec. 1986 p 113-121 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14470#** Joint Publications Research Service, Arlington, Va.
**TWO-LAYER MODEL OF CIRCULATION IN WORLD OCEAN WITH DETAILED DESCRIPTION OF SEASONAL EVOLUTION OF UPPER QUASIHOMOGENEOUS LAYER Abstract Only**
B. A. Kagan, V. A. Ryabchenko, and S. A. Fokin *In its* USSR Report: Earth Sciences 22 May 1987 p 38 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 291, no. 3, Nov. 1986 p 699-703 Original language document was announced in IAA as A87-29041 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14471#** Joint Publications Research Service, Arlington, Va.
**REMOTE ACOUSTIC SOUNDING OF FERROMANGANESE NODULES Abstract Only**
Yu. Yu. Zhitkovskiy, A. Yu. Zakhlestin, A. I. Zotov, V. I. Kayevitser, G. M. Petrov, and A. V. Sknarya *In its* USSR Report: Earth Sciences 22 May 1987 p 39 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 291, no. 3, Nov. 1986 p 697-699 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14472#** Joint Publications Research Service, Arlington, Va.
**FERROMANGANESE NODULES OF ANTARCTIC SECTOR IN PACIFIC OCEAN Abstract Only**
G. N. Baturin, V. N. Lukashin, and A. Ya. Shevchenko *In its* USSR Report: Earth Sciences 22 May 1987 p 45 Transl. into ENGLISH from Tikhookeanskaya Geologiya (Novosibirsk, USSR), no. 5, Sep. - Oct. 1986 p 23-28 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14473#** Joint Publications Research Service, Arlington, Va.
**STUDY OF EVOLUTION OF GULF STREAM CYCLINIC EDDY Abstract Only**
V. A. Bubnov, A. B. Zubin, L. V. Moskalenko, and A. S. Osadchiy *In its* USSR Report: Earth Sciences 22 May 1987 p 48 Transl. into ENGLISH from Okeanologiya (Moscow, USSR), v. 26, no. 5, Sep. - Oct. 1986 p 732-737 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14474#** Joint Publications Research Service, Arlington, Va.
**ROLE OF ANOMALOUS CURRENTS IN FORMATION OF OCEAN SURFACE TEMPERATURE FIELD Abstract Only**
L. I. Piterbarg *In its* USSR Report: Earth Sciences 22 May 1987 p 48-49 Transl. into ENGLISH from Okeanologiya (Moscow, USSR), v. 26, no. 5, Sep. - Oct. 1986 p 738-742 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14475#** Joint Publications Research Service, Arlington, Va.
**ERRORS IN RETRIEVING HYDROLOGICAL FIELDS AND FIELDS OF THEIR DIFFERENTIAL CHARACTERISTICS BY METHOD OF APPROXIMATION BY ORTHOGONAL FUNCTIONS Abstract Only**
O. P. Nikitin and Yu. Ya. Elken *In its* USSR Report: Earth Sciences 22 May 1987 p 49-50 Transl. into ENGLISH from Okeanologiya (Moscow, USSR), v. 26, no. 5, Sep. - Oct. 1986 p 743-750 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14476#** Joint Publications Research Service, Arlington, Va.
**HYDROCHEMICAL STRUCTURE OF GULF STREAM FRONTAL ZONE WATERS Abstract Only**
A. M. Chernyakova, S. G. Poyarkov, S. O. Borodkin, and Ye. A. Akhmetyeva *In its* USSR Report: Earth Sciences 22 May 1987 p 51 Transl. into ENGLISH from Okeanologiya (Moscow, USSR), v. 26, no. 5, Sep. - Oct. 1986 p 768-772 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

**N88-14478#** Joint Publications Research Service, Arlington, Va.
**MODERN CONCEPT CONCERNING TRANSPORT OF BOTTOM SEDIMENTS IN ABYSSAL REGIONS OF WORLD OCEAN Abstract Only**
A. A. Chistyakov and R. Ye. Krasovskaya *In its* USSR Report: Earth Sciences 22 May 1987 p 65 Transl. into ENGLISH from Ekspress-Informatsiya. Seriya: Morskaya Geologiya i Geofizika (Moscow, USSR), no. 11, 1986 p 1-7 (For primary document see N88-14455 06-42)
Avail: NTIS HC A06/MF A01

# 51 LIFE SCIENCES (GENERAL)

**N88-14601#** Joint Publications Research Service, Arlington, Va.
**JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES**
14 Sep. 1987 105 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-87-011) Copyright Avail: NTIS HC A06/MF A01
Articles from the open literature in the areas of aerospace medicine, agriculture, biochemistry, biotechnology, the environment, epidemiology, genetics, human factors, immunology, industrial medicine, laser bioeffects, marine mammals, medical science, microbiology, military medicine, molecular biology, nonionizing radiation effects, pharmacology, toxicology, physiology, public health, radiation biology, and virology are included. For individual titles, see N88-14602 through N88-14607.

**N88-14602#** Joint Publications Research Service, Arlington, Va.
**ELECTRON CYTOCHEMICAL DETECTION OF Ca(2)+-ATPase IN PROTONEMA OF MOSS FUNARIA HYGROMETRICA (H e d w.) UNDER HYPOGRAVITATION Abstract Only**
Ye. M. Nedukha *In its* JPRS Report: Science and Technology. USSR: Life Sciences 14 Sep. 1987 p 1 Transl. into ENGLISH from Tsitologiya i Genetika (Kiev, USSR), v. 21, no. 1, Jan. - Feb. 1987 p 3-6 (For primary document see N88-14601 06-51)
Copyright Avail: NTIS HC A06/MF A01
A study was made of the localization of Ca(2)+-ATPase in the cells of the portonema of funaria hygrometrica grown in a clinostat to assist in predicting the possibility of existence and adaptation of plants to weightlessness. Electron cytochemical studies of subapical protonema cells of funaria hygrometrica revealed localization of irregularly shaped electron-dense granules with morphology corresponding to the product of a cytochemical reaction. There was no ATPase activity in the plasmalemma of cells growing in the clinostat, apparently a result of disrupted functioning of the plasmalemma. Ca(2)+-ATPase did manifest activity with the cytoplasmic membranes in the clinostat. Author

**N88-14603#** Joint Publications Research Service, Arlington, Va.
**COMPARATIVE ANATOMIC ANALYSIS OF SEEDLING ORGANS OF PISUM SATIVUM (FABACEAE) CULTIVATED UNDER SPACE FLIGHT CONDITIONS Abstract Only**
Z. A. Novruzova, A. A. Aliyev, U. K. Alekperov, A. L. Mashinskiy, N. M. Chapari, and G. K. Ragimova *In its* JPRS Report: Science and Technology. USSR: Life Sciences 14 Sep. 1987 p 1-2 Transl. into ENGLISH from Botanicheskiy Zhurnal (Leningrad, USSR), v. 72, no. 5, May 1987 p 657-659 (For primary document see N88-14601 06-51)
Copyright Avail: NTIS HC A06/MF A01
A morphologic-anatomic study was performed of 29-day seedlings of Pisum sativum L cultivated on board the Salyut-7 spacecraft as a part of the Oazis 1-AM program and on control seedlings grown on earth under similar conditions of temperature, humidity and illumination. Analysis of the basic anatomic elements, leaf, stem and root, showed quantitative and slight qualitative differences among experimental specimens, probably a response of the plants to their growth conditions. The experimental conditions did not modify the development of the structural elements of the

organs. Differences were found only in the degree of sclerification of cells in the conducting bundles of the stem. Author

**N88-14604#** Joint Publications Research Service, Arlington, Va.
**PHOTOCHEMICAL CONVERSION OF NUCLEIC ACID COMPONENTS CATALYZED BY LUNAR SOIL Abstract Only** **c91**
Ye. A. Kuzicheva *In its* JPRS Report: Science and Technology. USSR: Life Sciences 14 Sep. 1987 p 15 Transl. into ENGLISH from Zhurnal Evolyutionnoy Biokhimii i Fiziologii (Leningrad, USSR), v. 23, no. 1, Jan. - Feb. 1987 p 3-8 (For primary document see N88-14601 06-51)
Copyright Avail: NTIS HC A06/MF A01

An assessment was conducted on the effects of lunar soil on photochemical transformation of uridine and uracil in the absence of oxygen, and comparison with the effects obtained with a synthetic analog of lunar soil. Studies with 150 micrometer thick films of uracil and uridine with an exposure surface area of 175 sq cm over the lunar regolite samples collected by the Luna-16 mission from the Sea of Fertility showed enhanced UV photolysis. The quantum yields for uracil photolysis (254 nm, 643,000 J/sq m) with and without the regolite were 0.32/1000 and 0.2/100 respectively. The corresponding figures for uridine with and without the lunar sample were 0.13/1000 and 0.11/1000. A mixture of metal oxides designed to simulate the lunar soil sample was ineffective as a catalyst of photolysis; however, a sample of SiO2 showed limited activity. Spectral and chromatographic analysis of UV-irradiated uracil samples on the lunar soil demonstrated the formation of a more complex but undefined molecular structure. Author

**N88-14605#** Joint Publications Research Service, Arlington, Va.
**DAILY DYNAMICS OF SOME PHYSIOLOGICAL INDICATORS OF MAN UNDER DESERT CONDITION Abstract Only** **c52**
A. I. Freynk, K. Amannepesov, G. F. Sultanov, Ya. G. Garlyyev, and A. A. Amiyants *In its* JPRS Report: Science and Technology. USSR: Life Sciences 14 Sep. 1987 p 69 Transl. into ENGLISH from Izvestiya Akademii Nauk Turkmenskoy SSR. Seriya Biologicheskikh Nauk (Ashkhabad, USSR), no. 6, Nov. - Dec. 1986 p 50-57 (For primary document see N88-14601 06-51)
Copyright Avail: NTIS HC A06/MF A01

The need to develop reliable recommendations for organization of rest and work regimes and to define safe limits of stress for maintaining health under desert conditions prompted a study of orthostatic stability in a group of healthy inhabitants, acclimated to desert conditions. Studies involved 11 healthy volunteers. The studies showed significant daily variations in indicators of heat exchange, gas exchange, and the cardiovascular system in the subjects. The period between 1200 and 1800 was a period of high stress on all regulatory systems due to heat stress. The healthy subjects were able, with slight rest, to implement regulatory mechanisms to compensate for the effect of high temperatures. The extreme effect of high temperature increased with increased physical exertion and was manifested by decrease of orthostatic stability in the hot hours. Subjects were not dehydrated. The extreme effect of temperature increased under additional physical exertion as shown by the decrease of orthostatic stability in the hot hours. Author

**N88-14606#** Joint Publications Research Service, Arlington, Va.
**INFRADIAN BIORHYTHMS OF HUMAN VITAL SIGNS Abstract Only** **c52**
N. N. Shabatura, V. G. Tkachuk, V. A. Fedko, and S. B. Paliyenko *In its* JPRS Report: Science and Technology. USSR: Life Sciences 14 Sep. 1987 p 71 Transl. into ENGLISH from Fiziologicheskiy Zhurnal (Kiev, USSR), v. 33, no. 2, Mar. - Apr. 1987 p 10-15 (For primary document see N88-14601 06-51)
Copyright Avail: NTIS HC A06/MF A01

Biorhythmic patterns were evaluated for a number of conventional vital signs in the case of 20 men, 20 to 24 years old, including two with neuromuscular disorders. The data led to the identification of two fundamental infradian patterns of activity, consisting of a circaseptadian rhythm (6.5 + or - 0.3 days) and, in the case of body temperature, an additional circadiseptadian rhythm (13.0 + or - 0.5 days). The longitudinal measurements were carried out over a 60 to 620 day period, demonstrating that social factors, while affecting vital sign biorhythms, do not have a primary role in their generation. Generation of the infradian rhythms appears to depend exclusively on endogenous mechanisms. Author

**N88-14607#** Joint Publications Research Service, Arlington, Va.
**PHYSICOCHEMICAL CORRELATES OF HUMAN ADAPTATION TO EXTREME ENVIRONMENTS Abstract Only** **c52**
A. F. Konkova, I. A. Magay, O. M. Shekhayeva, V. F. Sokolov, and M. N. Anufriyeva *In its* JPRS Report: Science and Technology. USSR: Life Sciences 14 Sep. 1987 p 71 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR. Seriya Biologicheskaya (Moscow, USSR), no. 1, Jan. - Feb. 1987 p 104-118 (For primary document see N88-14601 06-51)
Copyright Avail: NTIS HC A06/MF A01

A discussion is presented of the energetics involved in maintaining viable homeostasis while the human body is exposed to extreme environmental factors. The self-adjustment in metabolic processes is shown to be of such nature as to maintain critical parameters within a narrow range, with heat production serving as the criterion of adjustment. Even on initial stages of exposure or anticipated exposure to different environmental factors, energy production would increase two- to five-fold above the level of basal metabolism. The extent of changes during the transitional change in the process of adaptation to a new level of functional status reflects the overall stability of the system and its flexibility. The increase in the internal energy of the system represents the adaptability of the system. Studies on nine healthy athletes demonstrated that the system adjusts to maintain vital parameters, e.g., pH, temperature, acid-base balance, within a narrow range while functioning in the most optimal regime. Author

**N88-14608#** Joint Publications Research Service, Arlington, Va.
**JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES**
5 Nov. 1987 74 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-87-013) Avail: NTIS HC A04/MF A01

Topics in life sciences addressed include: agricultural science; biophysics; biotechnology; epidemiology; genetics; immunology; medicine; laser bioeffects; pharmacology; toxicology; radiation effects; physiology; public health; and psychiatry. For individual titles, see N88-14609 through N88-14613.

**N88-14609#** Joint Publications Research Service, Arlington, Va.
**HUMAN PHYSICAL FIELDS** **c52**
Grigoriy Lvov *In its* JPRS Report: Science and Technology. USSR: Life Sciences 5 Nov. 1987 p 8-11 Transl. into ENGLISH of Novosti Nauki i Tekhniki (Moscow, USSR), no. 24, 20 Dec. 1986 p 1-6 (For primary document see N88-14608 06-51)
Avail: NTIS HC A04/MF A01

The fields which occur around biological objects were researched. The initial findings of the experiments are discussed. B.G.

**N88-14610#** Joint Publications Research Service, Arlington, Va.
**EFFECT OF NIGHT WATCHES AND INTERMITTENT SLEEP ON STATE OF CIRCADIAN RHYTHMS OF PHYSIOLOGICAL FUNCTIONS OF FISHERMEN Abstract Only** **c52**
V. A. Skrupskiy *In its* JPRS Report: Science and Technology. USSR: Life Sciences 5 Nov. 1987 p 48 Transl. into ENGLISH from Gigiyena i Sanitariya (Moscow, USSR), no. 12, Dec. 1986 p 76-78 (For primary document see N88-14608 06-51)
Avail: NTIS HC A04/MF A01

A study of 3 groups of 6 fishermen with different watch schedules measured the effect of interrupted sleep and wakefulness on daily rhythms and adaptability of fishermen on a cruise. Group 1 slept through the night without interruption, groups 2 and 3 had intermittent sleep (day and night) and night watch.

Average age was 31 + or - 0.7 years and average length of sea duty was 5.2 + or - 0.8 years. The irregular sleep pattern contributed to disturbances of sleep and to change of time pattern of physiological functions. This may reduce the body's adaptability and may lead to disturbances of the circadian rhythm. Work schedules requiring disruptions of sleep should not exceed 90 days in order to avoid desynchronization and disadaptation.
Author

**N88-14611#** Joint Publications Research Service, Arlington, Va.
**NEUROPHYSIOLOGICAL ANALYSIS OF HYPOTHALAMIC REGULATION MECHANISMS OF PRIMARY SLEEP AND HYPOBIOSIS Abstract Only** **c52**
I. G. Karmanova, Ye. A. Aristakesyan, and N. V. Shilling *In its* JPRS Report: Science and Technology. USSR: Life Sciences 5 Nov. 1987 p 49 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 294, no. 1, May 1987 p 245-248 Original language document was announced in IAA as A87-46075 (For primary document see N88-14608 06-51)
Avail: NTIS HC A04/MF A01

Studies were carried out to investigate the influence of the hypothalamus on seasonal variations of the primary sleep/wakefulness cycle and to identify the nature of the effect of both sections of the hypothalamus on the formation of the electrical activity of the primordial hippocampus of amphibians. The EEG studies were performed in different seasons in frogs with electrodes implanted in the primordial hippocampus. Particular consideration is given to the influence of the destruction of the two sections of the hypothalamus on the sleep/wakefulness cycle.
IAA

**N88-14612#** Joint Publications Research Service, Arlington, Va.
**SLEEP INDUCED IN CAT BY ELECTRIC STIMULATION OF ACOUSTIC AND MOTOR AREAS IN BRAIN CORTEX Abstract Only**
D. E. Gelitashvili-Papidze and N. G. Eristavi *In its* JPRS Report: Science and Technology. USSR: Life Sciences 5 Nov. 1987 p 49 Transl. into ENGLISH from Soobshcheniya Akademii Nauk Gruzinskoy SSR (Tbilisi, USSR), v. 125, no. 2, Feb. 1987 p 335-388 (For primary document see N88-14608 06-51)
Avail: NTIS HC A04/MF A01

Experiments carried out on normal animals showed that repeated stimulation of acoustic and motor areas of the brain cortex led to induction of sleep. Experiments on adult cats under nembutal anesthesia supported this finding. Initial stimulation of these areas resulted in typical orientational reactions to sound, somewhat related to the intensity of the electric stimulus. Repeated stimulations induced the sleepy state and eventually sound sleep. Increase in stimuli led to even deeper sleep. An assumption was made that the same mechanism is involved in development of sleep due to repeated peripheral and direct stimulations. Author

**N88-14613#** Joint Publications Research Service, Arlington, Va.
**INFLUENCE OF GENERAL VERTICAL VIBRATION ON RELATIONSHIPS BETWEEN MEDIATORS IN VARIOUS SEGMENTS OF BRAIN Abstract Only** **c53**
A. S. Dmitriyev, M. Yu. Tayts, T. V. Dudina, and T. S. Kandybo *In its* JPRS Report: Science and Technology. USSR: Life Sciences 5 Nov. 1987 p 50 Transl. into ENGLISH from Doklady Akademii Nauk BSSR (Minsk, USSR), v. 31, no. 6, Jun. 1987 p 567-570 (For primary document see N88-14608 06-51)
Avail: NTIS HC A04/MF A01

The activity of the central neuromediator systems involved in the response reaction to the extreme influences was studied. Reception of corticosterone by various brain structures was studied, reflecting the reaction of the central nervous system to changes in the functional status of the hypothalamus-hypophysis-adrenocortical system. The work was performed on adult male Wistar rats following 2 hours general vertical vibration at 10 Hz, amplitude 1 mm, acceleration 2 m/sq s. The decrease in excitability of zones of the cortex and weakening of activation reaction in response to afferent signals are associated with the activation of the noradrenaline and serotoninergic systems. In the parietal cortex, significant changes occur in the reception of corticosterone, reflecting the variation in the choline, monoamine, and GABAergic neuronal activity with level of glucocorticoids in the body and the functional status of the hypothalamus-hypophysis-adrenocortical system.
Author

**N88-14868*#** Galveston Coll., Tex. Div. of Mathematics and Science.
**A SOLID PHASE ENZYME-LINKED IMMUNOSORBENT ASSAY FOR THE ANTIGENIC DETECTION OF LEGIONELLA PNEUMOPHILA (SEROGROUP 1): A COMPLIMENT FOR THE SPACE STATION DIAGNOSTIC CAPABILITY**
Kelly E. Hejtmancik *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 20 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 06B

# 52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

**N88-14614#** California Univ., San Diego, La Jolla. Lab. for Biological Dynamics and Theoretical Medicine.
**DIMENSIONAL ANALYSIS OF NONLINEAR OSCILLATIONS IN BRAIN, HEART AND MUSCLE**
G. Mayer-Kress, F. E. Yates, L. Benton, M. Keidel, W. Tirsch, S. J. Poeppl, and K. Geist (Los Alamos National Lab., N. Mex.) 1987 51 p Presented at the CNLS Workshop on Nonlinearity in Biology and Medicine, Los Alamos, N. Mex., 18 May 1987 Prepared in cooperation with Goettingen Univ., Federal Republic of Germany
(Contract W-7405-eng-36)
(DE87-014749; LA-UR-87-2881; CONF-8705193-2) Avail: NTIS HC A04/MF A01

We present some numerical studies on the dimensional analysis of temporal oscillations measured in the human electroencephalogram (EEG), heart rates (HR), and muscle tremor. We show that it is sufficient to characterize the individual system by a single dimension value alone. We give some detailed numerical analysis of the scaling structure of the attractors reconstructed from the time signal. Our methods are based on the concept of local gauge functions that we derive from the raw signals as well as from the transformed signal obtained from singular value decomposition. We were able to confirm and improve earlier results on the change of dimensionality of EEG signals. For heart rates and muscle tremor we observe significant changes in the dimensionality depending on the state of the system. We indicate which factors enter dimension estimates and where specific problems lie in each of the examples.
DOE

**N88-14615#** Lawrence Livermore National Lab., Calif.
**CURRENT STATUS OF HIGH POWER MICROWAVE EFFECTS AND SIMULATION**
H. S. Cabayan Dec. 1986 9 p Presented at the 3rd National Conference on High Power Microwave Technology for Defense Applications, Albuquerque, N. Mex., 1 Dec. 1986
(Contract W-7405-eng-48)
(DE87-004112; UCRL-95052; CONF-861240-18) Avail: NTIS HC A02/MF A01

This article is based in part on the findings of the HPM Effects Panel. The findings of the panel have been reported elsewhere, and are summarized here. Issues covered include potential upper bounds of the fluences from HPM weapons, the phenomenology of HPM system effects, critical issues in HPM system effects simulation and HPM simulation requirements.
DOE

**N88-14616*** National Aeronautics and Space Administration, Washington, D.C.
**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 305)**
Jan. 1988 80 p
(NASA-SP-7011(305); NAS 1.21:7011(305)) Avail: NTIS HC A05 CSCL 06E

This bibliography lists 230 reports, articles, and other documents introduced into the NASA scientific and technical information system in December, 1987. Author

**N88-14617#** Research Inst. of National Defence, Stockholm (Sweden).
**QUICK MEASUREMENT OF INDIVIDUAL STRESS REACTION LEVEL: DEVELOPMENT OF THE EMOTIONAL STRESS REACTION QUESTIONNAIRE (ESRQ)**
Gerry Larsson Apr. 1987 34 p In SWEDISH; ENGLISH summary Revised
(FOA-C-50050-5.3; ISSN-0347-7665; ETN-88-90747) Avail: NTIS HC A03/MF A01; Research Institute of National Defence, Stockholm, Sweden KR 50

The Emotional Stress Reaction Questionnaire (ESRQ) focuses on the emotional aspects of the acute stress reaction. The questionnaire provides an estimation of the magnitude of the stress reaction of an individual in a given situation in less than 1 min. Predictions of psychological coping potential can also be made. A presentation of how the ESRQ is derived from coping theory is given. The process of instrument development is described and instructions for usage and interpretation of the questionnaire are given. Normative data as well as assessments of reliability and validity are presented. ESA

**N88-14618** Technische Hogeschool Twente, Enschede (Netherlands). Afdeling Klinische Neurofysiologie.
**MODEL BASED MONITORING OF HUMAN SLEEP STAGES Ph.D. Thesis**
Bastiaan (Bob) Kemp 1987 137 p
(ISBN-90-9001448-9; B8709267; ETN-88-91355) Copyright Avail: Issuing Activity

Probabilistic models of sleep and of the sleep-related activity of brain, eyes, and muscles are proposed. The probabilistic generators in the models are Wiener, Poisson point, and Gaussian processes, and a Markov chain. The analysis algorithms, which are optimal for these models, were developed using nonlinear stochastic filtering theory and statistical detection theory. ESA

**N88-14619#** Gezondheidsraad, Hague (Netherlands).
**UV RADIATION: HUMAN EXPOSURE TO ULTRAVIOLET RADIATION**
10 Jun. 1986 177 p In DUTCH
(PB87-137410) Avail: NTIS HC E07/MF E01 CSCL 06R

Presented are recommendations for the safe use of artificially generated ultraviolet (UV) radiation. Exposure to radiation from UV lasers is not considered here, although some of the recommendations are also valid for radiation from this type of equipment. The report revises and extends the 1978 recommendations of the Health Council of the Netherlands on micrometer radiation, insofar as UV radiation (wavelength range 100 to 400 nm) is concerned. The 1978 report mainly discussed the unintentional exposure to electromagnetic radiation. The present report also considers extensively the intentional use of UV radiation sources, such as sun lamps, sun couches, solaria, etc., by the general public. GRA

**N88-14620#** McMaster Univ., Hamilton (Ontario). Dept. of Medicine.
**OXYGEN TRANSPORT DURING EXERCISE AT EXTREME SIMULATED ALTITUDE: OPERATION EVEREST 2**
John R. Sutton, John T. Reeves, Peter D. Wagner, Bertron M. Groves, Allen Cymerman, Mark K. Malconian, Paul B. Rock, Patricia M. Young, Stephen D. Walter, and Charles S. Houston (Vermont Univ., Burlington.) 21 May 1987 59 p
(Contract DAMD17-85-C-5206; Grants PHS-HL-14985; PHS-HL-17731)
(AD-A185720) Avail: NTIS HC A04/MF A01 CSCL 06J

A decrease in maximal oxygen uptake has been demonstrated with increasing altitude. However, direct measurements of individual links in the oxygen transport chain at extreme altitude have not been obtained previously. Subjects exercised on a cycle ergometer and heart rate was recorded by an electrocardiograph; ventilation, VO2 and VCO2 were measured by open circuit. Arterial and mixed venous blood samples were collected from indwelling radial or brachial and pulmonary artery catheters for analysis of blood gases, oxygen saturation and content, and lactate. As barometric pressure decreased, VO2 max decreased. This was associated with profound hypoxemia and hypocapnia. Considering the major factors responsible for transfer of oxygen from the atmosphere to the tissues, the most important adaptations occurred in ventilation where a fourfold increase in alveolar ventilation was observed. Diffusion from alveolus to end capillary blood was unchanged with altitude. Diffusion from the capillary to the tissue mitochondria increased with altitude. With increasing altitude, blood lactate was progressively reduced at maximal exercise while at any absolute and relative submaximal workload, blood lactate was higher. These findings suggest that while glycogenolysis may be accentuated at low workloads, it may not be maximally activated at exhaustion. GRA

**N88-14621#** Army Research Inst. of Environmental Medicine, Natick, Mass.
**MAXIMAL CARDIORESPIRATORY RESPONSES TO ONE- AND TWO-LEGGED CYCLING DURING ACUTE AND LONG-TERM EXPOSURE TO 4300m**
Charles S. Fulco, Paul B. Rock, Laurie Trad, Vincent Forte, Jr., and Bruce Ruscio 14 Jul. 1987 21 p
(AD-A185730) Avail: NTIS HC A03/MF A01 CSCL 06J

During exposure to high altitude, maximal oxygen consumption (V02max) is diminished immediately in proportion to the reduction in oxygen content of the inspired air. As the exposure lasts beyond a couple of days, there is an increase in arterial oxygen saturation. However, V02max does not increase possibly due to a reduction in cardiac output. The purpose of this investigation was to study the contribution of the increase in oxygen content to the working muscles without the potentially confounded problem of a reduced cardiac output. Seven male subjects (aged 17 to 24 years) performed one- and two-legged V02max tests on a cycle ergometer at sea level (SL), after 1 hour at 4300m simulated altitude (SA) and after two weeks of residence at the summit of Pikes Peak, CO. (PP;4300m). Cardiac output limits maximal performance during two-legged but not one-legged cycling. Since only one-legged V02max increased as more oxygen was made available to the working muscles then the altitude-induced reduction in cardiac output can be implicated as being responsible for the reduction in V02max during two legged cycling. GRA

**N88-14622#** Army Research Inst. of Environmental Medicine, Natick, Mass.
**EXERCISE IN THE HEAT: EFFECTS OF DINITROPHENOL ADMINISTRATION**
R. Francesconi, R. Hubbard, C. Matthew, M. Durkot, and M. Bosselaers 26 Jul. 1987 28 p
(AD-A185731) Avail: NTIS HC A03/MF A01 CSCL 06O

Although dinitrophenol (DNP) stimulates excessive heat production by uncoupling oxidative phosphorylation, its effects on performance and thermoregulation during exercise in the heat have not been assessed. DNP was administered in two equal dosages (20mg/kg, 30 min interval); the second injection was followed immediately by exercise (9.14m/min) in the heat (30 C) or at room temperature (21 C) until exhaustion or 99 min. At 21 C control (saline-treated) rats manifested a mean endurance of 94 min which was reduced to 32 min among DNP-treated animals. Respective increments in rectal temperature (T sub re) for both groups were 0.02 C/min and 0.08 C/min. At 30 C control rats ran for 65 min (Tre/min=0.05 C) while DNP-treated animals had a mean endurance of only 12 min (Tre/min-0.22 C). DNP-treated rats (30 C) certainly manifested no decrement in tail-skin heat

loss (Tsk/min=0.17 C vs 0.10 C) or saliva secretion (0.78g/min,DNP vs 0.19g/min, control) for their brief treadmill duration. Heat stress and DNP prevented the normal reduction in hematocrit and plasma protein levels during exercise while DNP increased osmolality and potassium levels post excercise. GRA

**N88-14623*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**AIRBORNE PARTICULATE MATTER IN SPACECRAFT**
Feb. 1988 15 p Presented at a Panel Discussion held in Houston, Tex., 23-24 Jul. 1987
(Contract NAS9-17200)
(NASA-CP-2499; S-570; NAS 1.55:2499) Avail: NTIS HC A03/MF A01 CSCL 06K

Acceptability limits and sampling and monitoring strategies for airborne particles in spacecraft were considered. Based on instances of eye and respiratory tract irritation reported by Shuttle flight crews, the following acceptability limits for airborne particles were recommended: for flights of 1 week or less duration (1 mg/cu m for particles less than 10 microns in aerodynamic diameter (AD) plus 1 mg/cu m for particles 10 to 100 microns in AD); and for flights greater than 1 week and up to 6 months in duration (0.2 mg/cu m for particles less than 10 microns in AD plus 0.2 mg/cu m for particles 10 to 100 microns in AD. These numerical limits were recommended to aid in spacecraft atmosphere design which should aim at particulate levels that are a low as reasonably achievable. Sampling of spacecraft atmospheres for particles should include size-fractionated samples of 0 to 10, 10 to 100, and greater than 100 micron particles for mass concentration measurement and elementary chemical analysis by nondestructive analysis techniques. Morphological and chemical analyses of single particles should also be made to aid in identifying airborne particulate sources. Air cleaning systems based on inertial collection principles and fine particle collection devices based on electrostatic precipitation and filtration should be considered for incorporation into spacecraft air circulation systems. It was also recommended that research be carried out in space in the areas of health effects and particle characterization. Author

**N88-14605#** Joint Publications Research Service, Arlington, Va.
**DAILY DYNAMICS OF SOME PHYSIOLOGICAL INDICATORS OF MAN UNDER DESERT CONDITION Abstract Only**
A. I. Freynk, K. Amannepesov, G. F. Sultanov, Ya. G. Garlyyev, and A. A. Amiyants *In its* JPRS Report: Science and Technology. USSR: Life Sciences 14 Sep. 1987 p 69 Transl. into ENGLISH from Izvestiya Akademii Nauk Turkmenskoy SSR. Seriya Biologicheskikh Nauk (Ashkhabad, USSR), no. 6, Nov. - Dec. 1986 p 50-57 (For primary document see N88-14601 06-51)
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**N88-14606#** Joint Publications Research Service, Arlington, Va.
**INFRADIAN BIORHYTHMS OF HUMAN VITAL SIGNS Abstract Only**
N. N. Shabatura, V. G. Tkachuk, V. A. Fedko, and S. B. Paliyenko *In its* JPRS Report: Science and Technology. USSR: Life Sciences 14 Sep. 1987 p 71 Transl. into ENGLISH from Fiziologicheskiy Zhurnal (Kiev, USSR), v. 33, no. 2, Mar. - Apr. 1987 p 10-15 (For primary document see N88-14601 06-51)
Copyright Avail: NTIS HC A06/MF A01

**N88-14607#** Joint Publications Research Service, Arlington, Va.
**PHYSICOCHEMICAL CORRELATES OF HUMAN ADAPTATION TO EXTREME ENVIRONMENTS Abstract Only**
A. F. Konkova, I. A. Magay, O. M. Shekhayeva, V. F. Sokolov, and M. N. Anufriyeva *In its* JPRS Report: Science and Technology. USSR: Life Sciences 14 Sep. 1987 p 71 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR. Seriya Biologicheskaya (Moscow, USSR), no. 1, Jan. - Feb. 1987 p 104-118 (For primary document see N88-14601 06-51)
Copyright Avail: NTIS HC A06/MF A01

**N88-14609#** Joint Publications Research Service, Arlington, Va.
**HUMAN PHYSICAL FIELDS**
Grigoriy Lvov *In its* JPRS Report: Science and Technology. USSR: Life Sciences 5 Nov. 1987 p 8-11 Transl. into ENGLISH of Novosti Nauki i Tekhniki (Moscow, USSR), no. 24, 20 Dec. 1986 p 1-6 (For primary document see N88-14608 06-51)
Avail: NTIS HC A04/MF A01

**N88-14610#** Joint Publications Research Service, Arlington, Va.
**EFFECT OF NIGHT WATCHES AND INTERMITTENT SLEEP ON STATE OF CIRCADIAN RHYTHMS OF PHYSIOLOGICAL FUNCTIONS OF FISHERMEN Abstract Only**
V. A. Skrupskiy *In its* JPRS Report: Science and Technology. USSR: Life Sciences 5 Nov. 1987 p 48 Transl. into ENGLISH from Gigiyena i Sanitariya (Moscow, USSR), no. 12, Dec. 1986 p 76-78 (For primary document see N88-14608 06-51)
Avail: NTIS HC A04/MF A01

**N88-14611#** Joint Publications Research Service, Arlington, Va.
**NEUROPHYSIOLOGICAL ANALYSIS OF HYPOTHALAMIC REGULATION MECHANISMS OF PRIMARY SLEEP AND HYPOBIOSIS Abstract Only**
I. G. Karmanova, Ye. A. Aristakesyan, and N. V. Shilling *In its* JPRS Report: Science and Technology. USSR: Life Sciences 5 Nov. 1987 p 49 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 294, no. 1, May 1987 p 245-248 Original language document was announced in IAA as A87-46075 (For primary document see N88-14608 06-51)
Avail: NTIS HC A04/MF A01

# 53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

**N88-14624#** Technische Hogeschool, Eindhoven (Netherlands).
**VISION OF DETAILS IN SPACE AND TIME Ph.D. Thesis**
Franciscus Johannes Blommaert 1987 186 p Sponsored by the Netherlands Organisation for the Advancement of Pure Research
(B8711402; ETN-88-91368) Avail: NTIS HC A09/MF A01

Temporal impulses and step responses of the human eye obtained psychophysically by a drift correcting perturbation technique are presented. Prediction of thresholds and latency on the basis of experimentally determined impulse responses is treated. The foveal point spread function as a determinant for detail vision is considered. Point spread function variation and visibility of details is discussed. Local visual responses in space and time are shown. Estimation of optical and neural imaging factors in letter confusion is studied. The effects of letter size on recognition at low contrast levels is tested. ESA

**N88-14613#** Joint Publications Research Service, Arlington, Va.
**INFLUENCE OF GENERAL VERTICAL VIBRATION ON RELATIONSHIPS BETWEEN MEDIATORS IN VARIOUS SEGMENTS OF BRAIN Abstract Only**
A. S. Dmitriyev, M. Yu. Tayts, T. V. Dudina, and T. S. Kandybo *In its* JPRS Report: Science and Technology. USSR: Life Sciences 5 Nov. 1987 p 50 Transl. into ENGLISH from Doklady Akademii Nauk BSSR (Minsk, USSR), v. 31, no. 6, Jun. 1987 p 567-570 (For primary document see N88-14608 06-51)
Avail: NTIS HC A04/MF A01

# 54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

For related information see also *16 Space Transportation.*

**N88-14625*#** Boeing Aerospace Co., Seattle, Wash.
**CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEMS (CELSS) CONCEPTUAL DESIGN OPTION STUDY**
Melvin Oleson and Richard L. Olson Jun. 1986 171 p
(Contract NAS2-11806)
(NASA-CR-177421; NAS 1.26:177421) Avail: NTIS HC A08/MF A01 CSCL 06K

Results are given of a study to explore options for the development of a Controlled Ecological Life Support System (CELSS) for a future Space Station. In addition, study results will benefit the design of other facilities such as the Life Sciences Research Facility, a ground-based CELSS demonstrator, and will be useful in planning longer range missions such as a lunar base or manned Mars mission. The objectives were to develop weight and cost estimates for one CELSS module selected from a set of preliminary plant growth unit (PGU) design options. Eleven Space Station CELSS module conceptual PGU designs were reviewed, components and subsystems identified and a sensitivity analysis performed. Areas where insufficient data is available were identified and divided into the categories of biological research, engineering research, and technology development. Topics which receive significant attention are lighting systems for the PGU, the use of automation within the CELSS system, and electric power requirements. Other areas examined include plant harvesting and processing, crop mix analysis, air circulation and atmosphere contaminant flow subsystems, thermal control considerations, utility routing including accessibility and maintenance, and nutrient subsystem design. Author

**N88-14626*#** Boeing Aerospace Co., Seattle, Wash.
**CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEMS (CELSS) PHYSIOCHEMICAL WASTE MANAGEMENT SYSTEMS EVALUATION**
M. Oleson, T. Slavin, F. Liening, and R. L. Olson Jun. 1986 146 p
(Contract NAS2-11806)
(NASA-CR-177422; NAS 1.26:177422; BAC-37) Avail: NTIS HC A07/MF A01 CSCL 06K

Parametric data for six waste management subsystems considered for use on the Space Station are compared, i.e.: (1) dry incineration; (2) wet oxidation; (3) supercritical water oxidation; (4) vapor compression distillation; (5) thermoelectric integrated membrane evaporation system; and (6) vapor phase catalytic ammonia removal. The parameters selected for comparison are on-orbit weight and volume, resupply and return to Earth logistics, power consumption, and heat rejection. Trades studies are performed on subsystem parameters derived from the most recent literature. The Boeing Engineering Trade Study (BETS), an environmental control and life support system (ECLSS) trade study computer program developed by Boeing Aerospace Company, is used to properly size the subsystems under study. The six waste treatment subsystems modeled in this program are sized to process the wastes for a 90-day Space Station mission with an 8-person crew, and an emergency supply period of 28 days. The resulting subsystem parameters are compared not only on an individual subsystem level but also as part of an integrated ECLSS. Author

**N88-14627#** Eurocontrol Experimental Centre, Bretigny (France).
**USE OF COLOUR ON ELECTRONIC DATA DISPLAYS (SECOND STUDY)**
H. David and J. Roelofsen Sep. 1986 79 p
(PB87-126744; EEC-199) Avail: NTIS HC E05/MF E05 CSCL 05H

A technique for the simulation of EDD codings was described in EEC Report number 171. In addition to the displays described in that report, thirty-two controllers (French and Portuguese) evaluated four alternative codings. Speed and subjective preference order was: color print on gray, red background for alerting; color print on grey, red characters for alerting; dark print on pastel color; enhanced monochrome (bright for alerting). GRA

**N88-14628#** Technology, Inc., San Antonio, Tex. Life Sciences Div.
**RESEARCH AND DEVELOPMENT OF ANTI-G LIFE SUPPORT SYSTEMS. PART 1: DEVELOPMENT AND EVALUATION OF UNIFORM-PRESSURE ANTI-G SUITS Final Report, 1 Apr. 1981 - 31 Jul. 1985**
Robert W. Krutz, Jr., Roy W. Thompson, Arnold G. Krueger, and Emily M. Gause Apr. 1987 53 p
(Contract F33615-81-C-0600)
(AD-A185658; USAFSAM-TR-86-36-Pt-1) Avail: NTIS HC A04/MF A01 CSCL 05H

A skin pressure measuring device was designed and fabricated to measure pressure actually applied to the lower body during anti-G suit inflation. This device was used with a variety of developmetal uniform pressure anti G suits; basketweave, multiple capstan, and reticulated foam suit designs were evaluated. Results indicated that owing to engineering incompatibilities involving weight, bulk, sizing, fitting, and effective pressure loss attributable to friction between the interdigitized tapes, the capstan approach is not a practical solution to developing a uniform pressure anti-G garment. The reticulated foam approach shows promise because of a tendency to retain its original shape when pressurized to high pressures. Further development of reticulated foam anti-G designs is recommended. GRA

**N88-14856*#** Texas A&M Univ., College Station. Dept. of Home Economics.
**THE DETERMINATION OF NUTRITIONAL REQUIREMENTS FOR SAFE HAVEN FOOD SUPPLY SYSTEM (EMERGENCY/SURVIVAL FOODS) Final Report**
Selina Ahmed *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 18 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 18 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 06H

**N88-14867*#** Pennsylvania State Univ., University Park. Dept. of Industrial Engineering.
**PREDICTION OF PHYSICAL WORKLOAD IN REDUCED GRAVITY ENVIRONMENTS Final Report**
Joseph H. Goldberg *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 20 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 05H

**N88-14882*#** Houston Univ., Tex. Dept. of Industrial Engineering.
**TOOLS AND TECHNOLOGIES FOR EXPERT SYSTEMS: A HUMAN FACTORS PERSPECTIVE Final Report**
Navaratna S. Rajaram *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 18 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 18 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 05H

**N88-14889*#** New York Univ., New York. Dept. of Applied Science.
**MODELING THE GROWTH DYNAMICS OF FOUR CANDIDATE CROPS FOR CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEMS (CELSS) Final Report**
Tyler Volk *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 17 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 17 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 06H

# 55 SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

No abstracts in this category.

# 59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

**N88-14629*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**A GENERAL SOLUTION TO THE SILHOUETTE PROBLEM**
David R. Hedgley, Jr. Feb. 1987 9 p
(NASA-TP-2695; H-1348; NAS 1.60:2695) Avail: NTIS HC A02/MF A01 CSCL 12A

In displaying computer-generated graphics, it is advantageous to have the facility to render any subset of polygons as a silhouette with respect to itself. While the silhouette problem has been addressed before, there has been no completely general solution. In this report, the silhouette problem for calligraphic drawings is solved for the most general case. This solution offers all possible combinations of silhouette and non-silhouette specifications for an arbitrary solid. It allows the flexibility to enhance the clarity of any three-dimensional scene presented in two dimensions. Author

**N88-14630*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**AN ORTHOGONAL ORIENTED QUADRATURE HEXAGONAL IMAGE PYRAMID**
Andrew B. Watson and Albert J. Ahumada, Jr. Dec. 1987 20 p
(NASA-TM-100054; A-88049; NAS 1.15:100054) Avail: NTIS HC A03/MF A01 CSCL 12A

An image pyramid has been developed with basis functions that are orthogonal, self-similar, and localized in space, spatial frequency, orientation, and phase. The pyramid operates on a hexagonal sample lattice. The set of seven basis functions consist of three even high-pass kernels, three odd high-pass kernels, and one low-pass kernel. The three even kernels are identified when rotated by 60 or 120 deg, and likewise for the odd. The seven basis functions occupy a point and a hexagon of six nearest neighbors on a hexagonal sample lattice. At the lowest level of the pyramid, the input lattice is the image sample lattice. At each higher level, the input lattice is provided by the low-pass coefficients computed at the previous level. At each level, the output is subsampled in such a way as to yield a new hexagonal lattice with a spacing sq rt 7 larger than the previous level, so that the number of coefficients is reduced by a factor of 7 at each level. The relationship between this image code and the processing architecture of the primate visual cortex is discussed. Author

# 60 COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing.

For components see *33 Electronics and Electrical Engineering.*

**N88-14631#** Maryland Univ., College Park. Dept. of Computer Science.
**OBJECTS ARCHITECTURE: A COMPREHENSIVE DESIGN APPROACH FOR REAL-TIME, DISTRIBUTED, FAULT-TOLERANT, REACTIVE OPERATING SYSTEMS**
Shem-Tov Levi and Ashok K. Agrawala Sep. 1987 30 p (Contract N00014-87-K-0124)
(AD-A185476; CS-TR-1915) Avail: NTIS HC A03/MF A01 CSCL 09B

The applicability of objects architecture for designing real-time reactive operating systems is examined through a model of its elements, their relationships and operations. The requirements of creation, deletion and manipulation of objects in a distributed system with a high degree of fault tolerance are introduced and analyzed. Then, the imposition of time constraints is introduced, and its influence on the objects architecture is analyzed. Relationships with other objects and additional fault tolerance relations are considered. Finally, examples of some solutions to fundamental real-time problems are proposed. GRA

**N88-14632#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
**A TAXONOMY OF ANALYTICAL COMPUTER PERFORMANCE MODELS FOR COMPUTER DESIGN M.S. Thesis**
Michael W. Strevell 1986 119 p
(AD-A185561; AFIT/CI/NR-87-97T) Avail: NTIS HC A06/MF A01 CSCL 09B

The computer architect has no easy way of making performance tradeoffs while designing a new computer. This thesis provides a taxonomy of over 75 weighted average computer performance models which aid the architect in comparing alternative designs. These models have been implemented in the KEE expert system building tool. The user can interact with the models using a mouse and visual images to change values and monitor results. GRA

**N88-14857*#** Norwich Univ., Northfield, Vt. Dept. of Computer Science Engineering.
**LIFE SCIENCES FLIGHT EXPERIMENTS MICROCOMPUTER Final Report**
Peter N. Bartram *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 10 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 10 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 09B

**N88-14880*#** Puerto Rico Univ., Mayaguez. Dept. of Electrical and Computer Engineering.
**FAULT-TOLERANT COMPUTER ARCHITECTURE BASED ON INMOS TRANSPUTER PROCESSOR Final Report**
Jorge L. Ortiz *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 15 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 15 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 09B

# 61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, alogorithms, and specific applications, e.g., CAD/CAM.

**N88-14633*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**OPTIMAL PRE-SCHEDULING OF PROBLEM REMAPPINGS Final Report**
David M. Nicol and Joel H. Saltz Sep. 1987 26 p Proposed for presentation at the 1988 SIGMETRICS Conference
(Contract NAS1-18107)
(NASA-CR-178378; ICASE-87-52; NAS 1.26:178378) Avail: NTIS HC A03/MF A01 CSCL 09B

A large class of scientific computational problems can be characterized as a sequence of steps where a significant amount of computation occurs each step, but the work performed at each step is not necessarily identical. Two good examples of this type of computation are: (1) regridding methods which change the problem discretization during the course of the computation, and (2) methods for solving sparse triangular systems of linear equations. Recent work has investigated a means of mapping such computations onto parallel processors; the method defines a family of static mappings with differing degrees of importance placed on the conflicting goals of good load balance and low communication/synchronization overhead. The performance tradeoffs are controllable by adjusting the parameters of the mapping method. To achieve good performance it may be necessary to dynamically change these parameters at run-time, but such changes can impose additional costs. If the computation's behavior can be determined prior to its execution, it can be possible to construct an optimal parameter schedule using a low-order-polynomial-time dynamic programming algorithm. Since the latter can be expensive, the performance is studied of the effect of a linear-time scheduling heuristic on one of the model problems, and it is shown to be effective and nearly optimal.
Author

**N88-14634#** Technische Hogeschool, Delft (Netherlands). Onderafdeling der Wiskunde en Informatica.
**PARALLEL ALGORITHMS FOR UNCONSTRAINED AND CONSTRAINED NONLINEAR OPTIMIZATION**
F. A. Lootsma [1986] 40 p
(PB87-230454; Rept-86-15) Copyright Avail: NTIS HC A03/MF A01 CSCL 09B

This survey is concerned with variants of nonlinear optimization methods designed for implementation on parallel computers. A particular type of parallelism is considered. First, the main sources of inspiration are concentrated on for unconstrained optimization: conjugate directions, variable metric methods, homogeneous functions, and multidimensional searches. Thereafter, two approaches are discussed that have been employed to solve constrained problems with separable objective and constraint functions: dual methods and quadratic approximations. Finally, the key issues are outlined in future computational studies of parallel nonlinear optimization algorithms.
Author

**N88-14635#** Technische Hogeschool, Delft (Netherlands). Onderafdeling der Wiskunde en Informatica.
**PARALLEL ALGORITHMS FOR POLYNOMIALS**
J. H. M. Andriessen 1986 34 p Presented at the 2nd SIAM Conference on Parallel Processing for Scientific Computing, Norfolk, Va., 21 Nov. 1985
(PB87-226304; Rept-86-23) Copyright Avail: NTIS HC A03/MF A01 CSCL 09B

Algorithms for polynomials are rather complex, but have much intrinsic parallelism. Pipeline algorithms, parallel pipeline algorithms, a parallel algorithm, and a task scheduling algorithm are discussed. The first three types of algorithms have fixed structures, implicitly required by the algorithm. The fourth type deals with a flexible allocation of tasks to a restricted number of subprocessors. The algorithms are described by their characteristics, such as the type of the processors and their number, the time and hardware complexity, the processing time, and the efficiency. Evaluation of the optimal configurations results in a slight preference of the fully parallel algorithm.
GRA

**N88-14636#** Vrije Universiteit, Amsterdam (Netherlands). Subfaculteit Wiskunde en Informatica.
**SET OF MULTI-PROCESS PRIMITIVES FOR STACK BASED MACHINES**
K. Bot and E. Scheffer Dec. 1986 30 p
(PB87-234381; IR-122) Avail: NTIS HC A03/MF A01 CSCL 09B

Primitives and higher level routines, implemented with these primitives, that can be used to simulate parallelism or to handle coroutine switching are described. The primitives can be written in a few lines of assembly code. Modula-2's newprocess and transfer can be easily implemented with these primitives. Higher level constructs like Occam's parallelism and channels can be expressed in the higher level routines.
GRA

**N88-14637#** Amsterdam Univ. (Netherlands). Dept. of Computer Science.
**WINDOW SYSTEM: A TOOLBOX FOR INTERACTIVE COMPUTER GRAPHICS M.S. Thesis**
J. vanderZijp Jan. 1987 79 p
(PB87-234282; FVI-87-02) Avail: NTIS HC A05/MF A01 CSCL 09B

This thesis consists of nine chapters; each chapter corresponds to some part of the window software, although not every part of the software is described in detail. The order chosen was such that the reader could, in principle, comprehend the material in a single pass.
GRA

**N88-14638*#** PRC Kentron, Inc., Hampton, Va.
**DIAGNOSTIC EMULATION: IMPLEMENTATION AND USER'S GUIDE**
Bernice Becher Dec. 1987 172 p
(Contract NAS1-18000)
(NASA-CR-178391; NAS 1.26:178391) Avail: NTIS HC A08/MF A01 CSCL 09B

The Diagnostic Emulation Technique was developed within the System Validation Methods Branch as a part of the development of methods for the analysis of the reliability of highly reliable, fault tolerant digital avionics systems. This is a general technique which allows for the emulation of a digital hardware system. The technique is general in the sense that it is completely independent of the particular target hardware which is being emulated. Parts of the system are described and emulated at the logic or gate level, while other parts of the system are described and emulated at the functional level. This algorithm allows for the insertion of faults into the system, and for the observation of the response of the system to these faults. This allows for controlled and accelerated testing of system reaction to hardware failures in the target machine. This document describes in detail how the algorithm was implemented at NASA Langley Research Center and gives instructions for using the system.
Author

**N88-14639#** Pacific Northwest Labs., Richland, Wash.
**THE ADAPTION AND USE OF RESEARCH CODES FOR PERFORMANCE ASSESSMENT**
A. M. Liebetrau May 1987 17 p Presented at the 4th Meeting of the Probabilistic Systems Assessment Codes User Group, London, United Kingdom, 10 Nov. 1986
(Contract DE-AC06-76RL-01830)
(DE88-000552; PNL-SA-14592; CONF-861141-1) Avail: NTIS HC A03/MF A01

Models of real-world phenomena are developed for many reasons. The models are usually, if not always, implemented in the form of a computer code. The characteristics of a code are determined largely by its intended use. Realizations or implementations of detailed mathematical models of complex physical and/or chemical processes are often referred to as

research or scientific (RS) codes. Research codes typically require large amounts of computing time. One example of an RS code is a finite-element code for solving complex systems of differential equations that describe mass transfer through some geologic medium. Considerable computing time is required because computations are done at many points in time and/or space. Codes used to evaluate the overall performance of real-world physical systems are called performance assessment (PA) codes. Performance assessment codes are used to conduct simulated experiments involving systems that cannot be directly observed. Thus, PA codes usually involve repeated simulations of system performance in situations that preclude the use of conventional experimental and statistical methods. DOE

**N88-14640#** Los Alamos National Lab., N. Mex.
**THE WILSON-FOWLER SPLINE IN A GLOBAL IGES (INITIAL GRAPHICS EXCHANGE SPECIFICATION) COORDINATE FRAME**
Robert M. Dolin Sep. 1987 109 p
(Contract W-7405-eng-36)
(DE88-001942; LA-11024-MS) Avail: NTIS HC A06/MF A01

This report re-examines the original Wilson-Fowler spline. The Wilson-Fowler spline is a two-dimensional, cubic, piecewise-smooth, curve-fitting algorithm. Its defining equations are redeveloped. The intended application of the redevelopment is the Initial Graphics Exchange Specification (IGES) environment. IGES is the current national geometry standard. Splines are by far the most ambiguous form of geometry that IGES deals with. The work contained in this report is an effort to understand the Wilson-Fowler spline, both how it works and how it can be applied to IGES. The two important features of our work are a global Wilson-Fowler spline definition and a scheme for computing normalized offsets. DOE

**N88-14641*#** Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
**ALGORITHMS AND PROGRAMMING TOOLS FOR IMAGE PROCESSING ON THE MPP:3 Final Report, May 1984 - Jul. 1987**
Anthony P. Reeves [1987] 186 p
(Grant NAG5-403)
(NASA-CR-182349; NAS 1.26:182349) Avail: NTIS HC A09/MF A01 CSCL 09B

This is the third and final report on the work done for NASA Grant 5-403 on Algorithms and Programming Tools for Image Processing on the MPP:3. All the work done for this grant is summarized in the introduction. Work done since August 1986 is reported in detail. Research for this grant falls under the following headings: (1) fundamental algorithms for the MPP; (2) programming utilities for the MPP; (3) the Parallel Pascal Development System; and (4) performance analysis. In this report, the results of two efforts are reported: region growing, and performance analysis of important characteristic algorithms. In each case, timing results from MPP implementations are included. A paper is included in which parallel algorithms for region growing on the MPP is discussed. These algorithms permit different sized regions to be merged in parallel. Details on the implementation and peformance of several important MPP algorithms are given. These include a number of standard permutations, the FFT, convolution, arbitrary data mappings, image warping, and pyramid operations, all of which have been implemented on the MPP. The permutation and image warping functions have been included in the standard development system library. Author

**N88-14642#** Cambridge Univ. (England). Dept. of Engineering.
**BALANCED REALIZATIONS: CANONICAL FORM, PARAMETRIZATION, MODEL REDUCTION**
R. J. Ober 1986 49 p
(PB87-123360; CUED/F-CAMS/TR-264) Avail: NTIS HC E05/MF E05 CSCL 09B

Balanced realizations are used to construct a canonical form for the set of minimal and asymptotically stable multiple input multiple output (MIMO) systems of a given order. A parameterization result is derived, which allows us to show a truncation property of this canonical form. Author

**N88-14643#** Amsterdam Univ. (Netherlands). Dept. of Computer Science.
**LEARNING TO PROGRAM METHODICALLY. 3: THE NEWLY DESIGNED COURSE OF THE ELEMENTARY PROGRAMMING**
D. Tromp Feb. 1986 51 p In DUTCH; In DUTCH
(PB87-119871; FVI-86-04) Avail: NTIS HC E04/MF E01 CSCL 09B

The notion of the explicit procedural meta-knowledge deemed necessary for solving programming problems, in combination with the knowledge of a programming language, is taken as a starting-point for considering a number of issues including educational objectives; existing courses; the domain concerned; and the functions of problem solving instruction. These considerations result in a summing-up of aspects of the new course, of which the procedure for programming methodically is probably the most salient. Some aspects are discussed more concretely, e.g., instructional materials, teaching methods, and testing materials. GRA

**N88-14644** Gesellschaft fuer Mathematik und Datenverarbeitung, St. Augustin (West Germany).
**NONCONFORMITY TESTING FOR THE GRAPHICAL KERNEL SYSTEM (GKS) [NORMKONFORMITAETSPRUEFUNG FUER GKS]**
Berthold Kirsch Jan. 1987 16 p In GERMAN
(GMD/VAL-86-104; ISBN-3-88457-105-2; ISSN-0724-9454; ETN-88-90581) Copyright Avail: Fachinformationszentrum, Karlsruhe, Fed. Republic of Germany

Nonconformity tests following the functional description standard DIN 66 252 were performed for implementations of the Graphical Kernel System. The fundamentals of the testing method, the test environment, and the preparations for the tests are described. The tests were successful, and no error in the implementation is found. The standard allows a large latitude for instrument and implementation dependencies, which makes it often difficult for the tests to make an unambiguous decision. ESA

**N88-14645#** Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
**DATA PROCESSING OF THE JPA INSTRUMENT. PART 1: DATA MANAGEMENT [IL TRATTAMENTO DEI DATI DELLO STRUMENTO JPA. PARTE UNA. LA GESTIONE DEI DATI]**
P. Torrente and E. Amata Dec. 1986 44 p In ITALIAN
(IFSI-86-15-Pt-1; ETN-88-91286) Avail: NTIS HC A03/MF A01

Each program of the set used to handle data from the JPA instrument of the Giotto mission is presented. The instrument, designed to study the interactions of solar wind with the Halley comet, includes a fast ion sensor (FIS), an implanted ion sensor (IIS) and a data processing unit. Onboard data processing reorganizes data in four distributions for FIS and three distributions for IIS. All data is subjected to a quasi-logarithmic compression. ESA

**N88-14646** Politecnico di Milano (Italy). Dipartamento di Elettronica.
**A SOFTWARE RELIABILITY MODEL WITH VARIABLE FAULT EXPOSURE COEFFICIENT**
Sergio Bittanti, Paolo Bolzern, and Riccardo Scattolini (Pavia Univ., Italy ) 1987 26 p Sponsored in part by CNR
(Rept-87-029; ETN-88-91303) Avail: Issuing Activity

A model for software reliability measure and prediction based on the observation that the fault exposure coefficient (FEC) may vary during the testing phase is proposed. By allowing for increasing and decreasing trends of the FEC, different failure growth curves can be modeled. Model parameters are estimated by maximum likelihood techniques. The results of the application of the model to two sets of real data are reported. ESA

**N88-14647#** Trondheim Univ. (Norway). Computing Centre.
**HOW TO ESTIMATE THE TOTAL NUMBER OF ERRORS IN A SOFTWARE SYSTEM**
T. Stalhane 12 Feb. 1986 25 p Prepared in cooperation with Selskapet for Industriell og Teknisk Forskning, Trondheim, Norway
(PB87-132130; ISBN-82-595-4233-1; STF14-A86014) Avail: NTIS HC E03/MF E03 CSCL 09B

The report discusses two ways to predict the total number of errors in a software system: the Jelinski Moranda model as modified by Forman and Singpurwalla; and a model suggested by the author. The report concludes that the latter model yields reliable results earlier in the debugging process. GRA

**N88-14648#** Norges Tekniske Hoegskole, Trondheim. Electronics Research Lab.
**BENCHMARKING AND EVALUATION OF HARDWARE DESCRIPTION LANGUAGES FOR DESIGN OF VLSI SYSTEMS**
K. Svarstad and E. J. Aas Jul. 1986 187 p Sponsored by Royal Norwegian Council for Scientific and Industrial Research, Oslo Prepared in cooperation with Selskapet for Industriell og Teknisk Forskning, Trondheim, Norway
(PB87-134557; ISBN-82-595-4269-2; STF44-A86103) Avail: NTIS HC E09/MF E09 CSCL 09B

The role of Hardware Development Languages (HDL) for specification, description, design, simulation and automated synthesis is briefly discussed. The requirements for the Nordic cooperative project NORSILC are presented and 5 HDLs are selected as candidates for a suitable high level VLSI design language. These are in alphabetical order: DACAPO, ELLA, HELIX, RTSla and TEXCIM/B. Each of these languages is presented briefly. The Am2910 microprogram controller is chosen as a suitable benchmark for the NORSILC objective, and models in each HDL system are developed and discussed. GRA

**N88-14649#** Utrecht State Univ. (Netherlands). Dept. of Computer Science.
**DISTRIBUTION OF RECORDS ON A RING OF PROCESSORS**
H. L. Bodlaender and J. vanLeeuwen Mar. 1986 36 p Sponsored by Nederlandse Organisatie voor Zuiver Wetenschappelijk Onderzoek, The Hague
(PB87-235784; RUU-CS-86-6) Avail: NTIS HC A03/MF A01 CSCL 09B

A simple version of the load distribution problem for ring networks of n processors is considered. Assume the networks know rounds. In each round a random processor receives a packet of information from some source that must be stored somewhere on the ring. By some protocol the record is moved to a node on the ring, where the record is stored. The authors propose and analyze some token-based protocols for this problem that attempt to minimize the maximum number of records stored at a node and/or the number of messages needed to achieve a fair load distribution on the average. Also discussed is how a deletion of records can be incorporated in the model, while preserving the properties of the protocols. Author

**N88-14650#** Utrecht State Univ. (Netherlands). Dept. of Computer Science.
**OCTREE DATA STRUCTURES AND CREATION BY STACKING**
W. R. Franklin and V. Akman Mar. 1986 14 p
(PB87-234795; RUU-CS-86-3) Avail: NTIS HC A03/MF A01 CSCL 09B

Efficient, compact data structures are necessary for the representation of octrees. Several concrete data structures for the octree abstract data type are compared in terms of storage space required and execution time needed to perform operations such as finding a certain node or obel. Compared are information theoretic minimal representations, digital search trees sometimes storing some information in an immediate mode without pointers, and storing the set of rays, which is often the most compact. A fast method to convert a quadric surface into rays is described. Finally, a new algorithm to stack these rays into an octree is given. Author

**N88-14651#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
**STRESS EFFECTS AND THE OPTIMUM FORMAT OF A SCROLLING SEVEN-LINE VDT TEXT WINDOW M.S. Thesis**
Stephen G. Atkins 1987 68 p
(AD-A185559; AFIT/CI/NR-87-83T) Avail: NTIS HC A04/MF A01 CSCL 09B

Several aerospace applications have been identified for small text windows incorporated into existing computer VDT display screens. These text windows will provide system designers and software engineers with a means of providing realtime interactive plain English instructions on the same VDT screen as graphic or numerical data to which the instructions pertain. In aerospace applications, the screen space available is expected to be very small. For purposes of this report, on screen windows are presumed to allow for no more than seven lines of text. This report evaluated the effect of time pressure or stress on a key formatting decision which designers must now make concerning these text windows. The NASA Human Factors Laboratory (in conjunction with Lockheed) has run an experiment to determine the most appropriate location (within a seven-line text window) for the current operative instruction (i.e., the current open check-item). This experiment presents a simplified version of a proposed Shuttle/Space Station VDT screen text window with the current operative line-item at the top, middle, or bottom of the inserted text window. This student engineering report centers around a modification to the original NASA/Lockheed experiment. An additional factor was applied to the experiment. Appropriate background material is included to support the student's contention that time stress may have a significant interaction effect on optimal location of the current operative line-item within a seven-line text window. GRA

**N88-14652#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
**VIRTUAL IMAGE PROCESSOR: A PROTOTYPE IMPLEMENTATION M.S. Thesis**
Robert A. Kaucic, Jr 1987 47 p
(AD-A185560; AFIT/CI/NR-87-98T) Avail: NTIS HC A03/MF A01 CSCL 09B

A prototype virtual image processor has been developed for low-cost image processing applications, and has been implemented on three seperate image processors using an IBM PC/AT as a host. Application programs make device-independent calls to the virtual image processor which is currently implemented as sets of library calls and linked into the porting of application programs at compliation time, which facilitated the porting of application software among different image processors. The virtual image processor can be used as an aid in the development of portable image processing software or as an educational tool for students new to the field of image processing. GRA

**N88-14653#** Cornell Univ., Ithaca, N.Y. Dept. of Theoretical and Applied Mechanics.
**DEVELOPMENT OF SYMBOLIC COMPUTATION METHODS FOR NONLINEAR DYNAMICS Final Report, 30 Jul. 1984 - 29 Dec. 1985**
R. H. Rand 14 Jul. 1987 8 p
(Grant AF-AFOSR-0311-84)
(AD-A185562; AFOSR-87-1344TR) Avail: NTIS HC A02/MF A01 CSCL 09B

Under the supervision of principal investigator R.H. Rand, software has been written in MACSYMA which automatically performs normal form computations for systems of nonlinear nonauotnomous differential equations. We have produced a package which permits the user to perform Taylor expansion near identity transformations with unevaluated coefficients on a system of autonomous ordinary differential equations (valid to terms of arbitary order), and then to choose the transformation coefficients so that the resulting system is in normal form. This work has been applied to thenonlinear parametric stiffness control of flexible systems by Professors Moon and Rand, and to the dynamics of coupled van der Pol oscillators. GRA

**N88-14654#** Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
**LISP: A LANGUAGE FOR STRATIFIED DESIGN**
Harold Abelson and Gerald J. Sussman Aug. 1987 32 p
(Contract N00014-86-K-0180)
(AD-A185606; AI-M-986) Avail: NTIS HC A03/MF A01 CSCL 09B

We exhibit programs that illustrate the power of Lisp as a language for expressing the design and organization of computational systems. The examples are chosen to highlight the importance of abstraction in program design and to draw attention to the use of procedures to express abstractions. This article exhibits programs that illustrate the power of Lisp as a language for expressing the design and organization of computational systems. The examples are chosen to highlight the importance of abstraction in program design and to draw attention to the use of proceduces to express abstractions. Any programming language provides primitive components, means by which these can be combined, and means by which patterns of combination can be named and manipulated as if they were primitive. With appropriate abstractions to separate the specification of components from the details of their implementation we can provide a library of standard components that can be freely interconnected, allowing great flexibility in design. GRA

**N88-14655#** Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
**INTERACTION OF DIFFERENT MODULES IN DEPTH PERCEPTION: STEREO AND SHADING Memorandum Report, May 1986 - May 1987**
Heinrich H. Buelthoff and Hanspeter A. Mallot May 1987 25 p
(Contracts N00014-85-K-0124; N00014-85-C-0038)
(AD-A185607; AI-M-965; CBIP-024) Avail: NTIS HC A03/MF A01 CSCL 09B

A method has been developed to measure the perceived depth of computer generated images of simple solid objects. Computer graphic techniques allow for independent control of different depth cues (stereo, shading, and texture) and enable the investigator thereby to study psychophysically the interaction of modules for depth from shading and stereo and vetoing of depth from shading by edge information have been found. Cooperativity and other types of interactions are discussed. If intensity edges are missing, as in smooth-shaded surfaces, the image intensities themselves could be used for stereo matching. The results are compared with computer vision algorithms for both single modules and their integration for three-dimensional visual perception. GRA

**N88-14656#** Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
**COMPUTING BLOCK-ANGULAR KARMARKER PROJECTIONS WITH APPLICATIONS TO STOCHASTIC PROGRAMMING, REVISION**
John R. Birge and Liqun Qi Dec. 1986 18 p Prepared in cooperation with Pittsburgh Univ., Pa.
(Contract N00014-86-K-0628; Grant NSF ECS-83-04065)
(AD-A185647; TR-85-12-Rev) Avail: NTIS HC A03/MF A01 CSCL 12A

A variant of Karmarkar's projective algorithm is presented for block angular structured linear programs, such as stochastic linear programs. By computing the projection efficiently, the authors give a worst case bound on the order of the running time that can be an order of magnitude better than that of Karmarkar's standard algorithm. A related variant is applied to the dual program, and its implications for very large-scale problems are given.
Author (GRA)

**N88-14657#** Naval Postgraduate School, Monterey, Calif.
**KNOT SELECTION FOR LEAST SQUARES THIN PLATE SPLINES Technical Report, Jan. 1986 - Jul. 1987**
John R. McMahon and Richard Franke Sep. 1987 27 p
(AD-A185681; NPS-53-87-005) Avail: NTIS HC A03/MF A01 CSCL 09B

An algorithm for selection of knot point locations for approximation of functions from large sets of scattered data by least squares Thin Plate Splines is given. The algorithm is based on the idea that each data point is equally important in defining the surface, which allows the knot selection process to be decoupled from the least squares. Properties of the algorithm are investigated, and examples demonstrating it are given. Results of some least squares approximate are given and compared with other approximation methods. Author (GRA)

**N88-14658#** International Business Machines Corp., San Jose, Calif. Almaden Research Center.
**PROGRESS IN MATHEMATICAL PROGRAMMING**
Nimrod Megiddo 4 Mar. 1987 22 p
(Contract N00014-87-G-0037)
(AD-A185729) Avail: NTIS HC A03/MF A01 CSCL 09B

Most of the progress reported at the conference was on the theoretical side. Several new polynomial algorithms for linear programming were presented. The common feature to most of the new polynomial algorithms is the path-following aspect. The method of McCormick-Sofer for convex programming also follows a path. Efforts in the theoretical analysis of algorithms are also reported. Of special interest, although not in the main direction discussed at the conference, was the report by Rinaldi on the practical solution of some large traveling salesman problems. At the time of the conference it was still not clear whether the new algorithms developed since Karmarkar's algorithm would replace the simplex method in practice. Alan Hoffman presented results on conditions under which linear programming problems can be solved by greedy algorithms. In other presentations, Fourer-Gay-Kernighan presented a programming language (AMPL) for mathematical programming, David Gay presented graphic illustrations of the performance of Karmarkar's algorithm, and James Ho discussesd embedding of linear programming in commonly used spreadsheets. GRA

**N88-14659#** Air Force Geophysics Lab., Hanscom AFB, Mass.
**A COMPUTER DECISION-MAKING PROCESS FOR THE ELIMINATION OF NOISE FROM DATA**
Robert O. Berthel 27 Mar. 1987 26 p
(AD-A185746; AFGL-TR-87-0118; AFGL-ERP-972) Avail: NTIS HC A03/MF A01 CSCL 09B

Data acquired in many scientific and engineering activities are contaminated by noise or extraneous readings that are superimposed on base-line values. Automated data-analysis routines normally resort to some form of numerical averaging to suppress noise with the assumption that the smoothed values will closely approximate the base data. There are, however, circumstances where averaging may not produce acceptable results such as in situations of severe noise that are biased in magnitude and polarity. The Air Force Geophysics Laboratory was faced with this problem in the analysis of snow weight/rate data because of wind acceptable error boundaries. It was then noted that the base values could be very closely replicated by a hand-drawn, best guess line on the plotted noisy-raw data. This revelation prompted the development of a computer process that, by mimicking the logic of human reasoning, can eliminate extraneous readings and reconstruct the base-line data to a very close approximation. As such, this computer decision-making procedure may be classified as a form of artifical intelligence that may be applicable to other analytical routines. This report discusses the problems associated with extraneous or noisy data and describes the technique that was developed to eliminate superfluous readings from snow weight/rate measurements. GRA

**N88-14660#** California Univ., Berkeley. Dept. of Industrial Engineering and Operations Research.
**ON THE WORK NEEDED TO FACTOR A SYMMETRIC POSITIVE DEFINITE MATRIX**
Marcio de Carvalho Jun. 1987 25 p
(Contract N00014-87-K-0202)
(AD-A185781; ONR-87-14) Avail: NTIS HC A03/MF A01 CSCL 09B

When comparing different row ordering strategies, the measure often used is the fill-in, or the number of additional non-zeroe elements. This report proposes one other measure: the number of arithmetic operations necessary to factor the matrix. Two classical ordering strategies: Minimum Degree and Minimum Local Fill-in are compared with respect to this measure. Minimum Local Fill-in usually produces better results than Minimum Degree. Also, an application is presented where the number of arithmetic operations may be a more interesting measure of performance i.e., Karmarkar's Linear Programming Algorithm. Author (GRA)

**N88-14661#** National Bureau of Standards, Gaithersburg, Md. Center for Applied Mathematics.
**INTERACTIVE NONLINEAR LEAST SQUARES PROGRAM**
C. M. Wolfe, B. W. Rust, J. H. Dunn, and I. E. Brown Jul. 1987 163 p
(PB88-109855; NBS/TN-1238) Avail: NTIS HC A08/MF A01; also available SOD HC $8.00 as 003-003-02815-1 CSCL 09B

INVAR is an interactive computer code which uses the Stanford variable-separable nonlinear regression program VARPRO to solve nonlinear and linear least squares problems. The variable-separable feature of VARPRO makes it attractive to users with real-world fitting problems because it iterates only on the parameters which appear nonlinearly in the model. Not only does this simplify the iteration, but it also means that the user is not required to supply initial estimates for the parameters which appear linearly. INVAR implements VARPRO within an environment providing the user with on-line feedback and the opportunity to make changes, transformations, and corrections in real time. It provides extensive statistical diagnostics and plots of the results. The report is both a tutorial guide for beginners and a reference manual for experienced users who wish to make changes in the code. It contains three completely solved example problems. Three appendices contain information necessary for making changes in the programs. GRA

**N88-14662*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**PARALLEL PIVOTING COMBINED WITH PARALLEL REDUCTION Final Report**
Gita Alaghband (Colorado Univ., Denver.) Dec. 1987 41 p Submitted for publication
(Contracts NAS1-17070; NAS1-18107)
(NASA-CR-178422; ICASE-87-75; NAS 1.26:178422) Avail: NTIS HC A03/MF A01 CSCL 09B

Parallel algorithms for triangularization of large, sparse, and unsymmetric matrices are presented. The method combines the parallel reduction with a new parallel pivoting technique, control over generations of fill-ins and a check for numerical stability, all done in parallel with the work being distributed over the active processes. The parallel technique uses the compatibility relation between pivots to identify parallel pivot candidates and uses the Markowitz number of pivots to minimize fill-in. This technique is not a preordering of the sparse matrix and is applied dynamically as the decomposition proceeds. Author

**N88-14663#** Utrecht State Univ. (Netherlands). Dept. of Computer Science.
**ADAPTIVE GRID FOR POLYHEDRAL VISIBILITY IN OBJECT SPACE: AN IMPLEMENTATION**
W. R. Franklin and V. Akman Mar. 1986 15 p
(PB88-100938; RUU-CS-86-4) Avail: NTIS HC A03/MF A01 CSCL 09B

The paper presents an implementation of Franklin's object space hidden surface algorithm for polyhedral scenes. It is known that if the faces are independently and identically distributed, this algorithm performs in time linear in the number of faces and, in particular is not affected by the depth complexity. The algorithm overlays a grid on the scene with fineness depending on the statistics of the edges and the faces. It then preprocesses the edges and the faces in a grid data structure so that distant edges and faces will not be compared. The implementation of the algorithm on a Prime 750 using Ratfor shows that it is indeed very fast for random and structured scenes alike. GRA

**N88-14664#** Vrije Universiteit, Amsterdam (Netherlands). Subfaculteit Wiskunde en Informatica.
**MINIX: A UNIX CLONE WITH SOURCE CODE**
A. S. Tanenbaum Dec. 1986 12 p
(PB88-100862; IR-119) Avail: NTIS HC A03/MF A01 CSCL 09B

MINIX is a complete rewrite of UNIX. Neither the kernel nor the utility programs contains any AT and T code, so the source code is free of the AT and T licensing restrictions and may be studied by individuals or in a course. The system runs on the IBM PC, XT, or AT, and does not require a hard disk, thus making it possible for individuals to acquire a UNIX-like system for home use at a very low cost. Internally, MINIX is structured completely differently from UNIX. It is a message passing system on top of which are memory and file servers. User processes can send messages to these servers to have system calls carried out. The paper describes the motivation and intended use of the system, what the distribution contains, and discusses the system architecture in some detail. GRA

**N88-14871*#** Houston Univ., Tex. Dept. of Mathematics.
**SOME VISION ALGORITHMS Final Report**
Gordon G. Johnson *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 16 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 16 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 09B

**N88-14884*#** Houston Univ., Tex. Dept. of Industrial Engineering.
**SPACE STATION SOFTWARE RELIABILITY ANALYSIS BASED ON FAILURES OBSERVED DURING TESTING AT THE MULTISYSTEM INTEGRATION FACILITY Final Report**
Tak Chai Tamayo *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 20 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 09B

# 62 COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

**N88-14665#** Vrije Universiteit, Amsterdam (Netherlands). Subfaculteit Wiskunde en Informatica.
**WIDE-AREA COMMUNICATION UNDER AMOEBA**
R. vanRenesse and H. vanStaveren Dec. 1986 14 p
(PB87-234431; IR-117) Avail: NTIS HC A03/MF A01 CSCL 09B

The design and implementation of a wide-area gateway service that makes it possible to execute Amoeba transactions over existing long-haul networks are described. Furthermore, the specification of the interface between network drivers and the gateway is given. Finally, it describes how to use the gateway service. GRA

**N88-14666*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**ESTIMATING THE DISTRIBUTION OF FAULT LATENCY IN A DIGITAL PROCESSOR**
Erik L. Ellis and Ricky W. Butler Nov. 1987 22 p
(NASA-TM-100521; NAS 1.15:100521) Avail: NTIS HC A03/MF A01 CSCL 09B

Presented is a statistical approach to measuring fault latency in a digital processor. The method relies on the use of physical fault injection where the duration of the fault injection can be

controlled. Although a specific fault's latency period is never directly measured, the method indirectly determines the distribution of fault latency. Author

**N88-14667#** Rome Univ. (Italy). Dipartimento di Fisica.
**A NEW LIBRARY OF CAMAC ROUTINES FOR THE CONTROL OF THE SYSTEM CRATE BY A MICROVAX IN THE VAXELN ENVIRONMENT**
A. Giannasca, E. Lamanna, G. Mancarella, O. Palamara, L. Petrillo, and A. Surdo (Lecce Univ., Italy ) 27 Jul. 1987 36 p
(Nota-Interna-893; ETN-88-91254) Avail: NTIS HC A03/MF A01

A library of CAMAC routines implemented using the digital VAXELN development system to perform input/output operations on CAMAC from microVAX is described. The CES SCI 2280 module is used as Qbus-CAMAC interface. The first part of the library follows the NIM/ESONE recommendations. The second part contains a set of routines optimized for fast accesses to the CAMAC. The routines manage single CAMAC operations, sequences of single CAMAC operations, LAM service and block transfer via direct memory access (DMA), using the CES AMC 2281 as hardware DMA control module. The software will be used in the data acquisition system of the MACRO experiment. ESA

**N88-14668*#** Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Electrical and Computer Engineering.
**SOFTWARE-IMPLEMENTED FAULT INSERTION: AN FTMP EXAMPLE**
Edward W. Czeck, Daniel P. Siewiorek, and Zary Z. Segall Oct. 1987 34 p
(Grant NAG1-190)
(NASA-CR-178423; NAS 1.26:178423) Avail: NTIS HC A03/MF A01 CSCL 09B

This report presents a model for fault insertion through software; describes its implementation on a fault-tolerant computer, FTMP; presents a summary of fault detection, identification, and reconfiguration data collected with software-implemented fault insertion; and compares the results to hardware fault insertion data. Experimental results show detection time to be a function of time of insertion and system workload. For the fault detection time, there is no correlation between software-inserted faults and hardware-inserted faults; this is because hardware-inserted faults must manifest as errors before detection, whereas software-inserted faults immediately exercise the error detection mechanisms. In summary, the software-implemented fault insertion is able to be used as an evaluation technique for the fault-handling capabilities of a system in fault detection, identification and recovery. Although the software-inserted faults do not map directly to hardware-inserted faults, experiments show software-implemented fault insertion is capable of emulating hardware fault insertion, with greater ease and automation. Author

**N88-14864*#** Auburn Univ., Ala. Dept. of Chemistry.
**DEVELOPMENT OF A GRAPHICAL DISPLAY ON THE DMS TEST BED Final Report**
Robert A. Donnelly *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 9 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 9 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 09B

# 63 CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems.

For related information see also *54 Man/System Technology and Life Support.*

**N88-14669#** Joint Publications Research Service, Arlington, Va.
**USSR REPORT: CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY**
9 Dec. 1986 86 p Transl. into ENGLISH from various Russian articles
(JPRS-UCC-86-014) Avail: NTIS HC A05/MF A01

Translated articles from USSR technical journals and other periodicals are presented. Computer programs, computer applications, computer networks, and education are general areas of discussion. For individual titles, see N88-14670 through N88-14670.

**N88-14670#** Joint Publications Research Service, Arlington, Va.
**ARTIFICIAL INTELLIGENCE SYSTEMS**
G. Kochetkov and V. Sergeyev *In its* USSR Report: Cybernetics, Computers and Automation Technology 9 Dec. 1986 p 22-26 Transl. into ENGLISH from Ekonomicheskaya Gazeta (Moscow, USSR), no. 31, Jul. 1986 p 21 (For primary document see N88-14669 06-63)
Avail: NTIS HC A05/MF A01

The development and history of artificial intelligence systems is discussed. The competition and militarism of the U.S. and Japan as concerns expert systems is also discussed. The spheres for expansion of practical application of artificial intelligence are examined. Author

**N88-14671#** University Coll., London (England). Dept. of Computer Science.
**COMPUTER ARCHITECTURES FOR ARTIFICIAL INTELLIGENCE**
P. C. Treleaven, A. N. Refenes, K. J. Lees, and S. C. McCabe Mar. 1986 122 p
(PB87-123824; UCL-CS-TR-119) Avail: NTIS HC E07/MF E07 CSCL 09B

Novel computer architectures to support Artificial Intelligence (AI) applications and AI programming languages are under development in the United States, Japan, and Europe. The AI application area having greatest influence on computer architecture is knowledge-based expert systems. Knowledge-based systems are programs that embody the specialized knowledge of human experts sufficient to perform as consultants. For programming these systems, the most suitable languages support symbolic computation. Symbolic programming languages divide into three broad classes: functional (e.g., LISP); logical (e.g., PROLOG); and what the authors refer to as Knowledge-Based languages (e.g., OPS5). GRA

**N88-14672*#** National Aeronautics and Space Administration, Washington, D.C.
**KNOWLEDGE ACQUISITION FOR A SIMPLE EXPERT CONTROLLER**
B. Bieker Nov. 1987 33 p Transl. into ENGLISH from Automatisierungstechnische Praxis Atp. (West Germany), v. 28, no. 9, 1986 p 448-457 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TT-20118; NAS 1.77:20118) Avail: NTIS HC A03/MF A01 CSCL 09B

A method is presented for process control which has the properties of being incremental, cyclic and top-down. It is described on the basis of the development of an expert controller for a simple, but nonlinear control route. A quality comparison between expert controller and process operator shows the ability of the method for knowledge acquisition. Author

**N88-14673** Politecnico di Milano (Italy). Dipartamento di Elettronica.
**A MULTIPURPOSE ADAPTIVE CONTROLLER (MAC) FOR REAL TIME DIGITAL REGULATION**
S. Bittanti, D. W. Clarke, and R. Scattolini 1987 20 p Sponsored by CNR and the Ministry of Public Education
(Rept-87-028; ETN-88-91302) Avail: Issuing Activity

A Multipurpose Adaptive Controller (MAC) was developed to supply a software and hardware environment for the development of self tuning algorithms. The MAC is a flexible tool for the performance evaluation of self tuning techniques in process control. The device offers a full range of testing possibilities via simulation. The MAC is constituted by a PC equipped with a 256kB RAM memory and a single board analog and digital I/O system DT2801 (Data Translation). The software relies on the package Fortran Application Universal Self Tuner, the so called generalized minimum variance technique is implemented. Both ARIMAX and ARIMAX models can be used. ESA

**N88-14674#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
**USING CONCEPT MAPPING TO DEFINE PROBLEMS AND IDENTIFY KEY KERNELS DURING THE DEVELOPMENT OF A DECISION SUPPORT SYSTEM M.S. Thesis**
Michael R. McFarren Jun. 1987 298 p
(AD-A185636; AFIT/GST/ENS/87J-12) Avail: NTIS HC A13/MF A01 CSCL 09B

How does a decision support system (DSS) designer identify the kernal(s) or key decision elements of a problem, from the user's perspective, and develop a design for a DSS from them? The problem arises because DSS adaptive design says start small and grow, but there are no suggestions on where to start. This thesis addresses the primary challenge by developing the tool, concept mapping, as a means to identify kernals in a decision process. This is a descriptive process that defines the problem space, describes the decision process, and identifies the key steps of the decision process as potential kernals. Beyond this initial challenge is the challenge of integrating concept mapping into the adaptive design process. This thesis effort will take the technique of concept mapping and use it to extract the information about a problem from the decision maker himself. The result of this extraction should be a well defined problem space, a sufficiently described decision process and a means to identify the kernals. Finally, the effort turns to integrating concept mapping into the adaptive design process. The integration of concept mapping into the adaptive design process is accomplished through a process called the problem definition process (PDP). GRA

**N88-14675#** Ballistic Research Labs., Aberdeen Proving Ground, Md.
**GENIE INFERENCE ENGINE RULE WRITER'S GUIDE Final Technical Report, Jun. 1986 - Apr. 1987**
Frederick S. Brundick Aug. 1987 49 p
(AD-A185709; BRL-TR-2832) Avail: NTIS HC A03/MF A01 CSCL 09B

An expert system is a program that mimics the performance of a human expert in some intellectual endeavor. The inference engine is the heart of the expert system. Genie (GENeric Inference Engine) is a rule-based expert system shell that was initially developed as the basis of an expert system to assist human experts in assessing the vulnerability of turbine jet engines. It is also being used to guide statisticians in performing non-para-metric analyses. The program is best suited for diagnostic and classification problems. The report is intended for the person creating a knowledge base to be used by Genie. A sample knowledge base will be built to show how Genie's various keywords work and how production rules are written. Detailed definitions and restrictions of the keywords, two sample knowledge bases, and sample runs are presented in the appendices. A glossary is included to explain the terms used. An inference engine shell will aid the development of future expert systems, while the expert systems themselves will make the vulnerability analysts's job much easier. This guide will enable anyone to create his own expert system. enable anyone to create his own expert system. GRA

**N88-14875*#** Houston Univ., Tex. Dept. of National Sciences.
**A GENERAL ARCHITECTURE FOR INTELLIGENT TRAINING SYSTEMS Final Report**
R. Bowen Loftin *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 15 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 15 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 09B

## 64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

**N88-14676#** Warwick Univ. Coventry (England). Control Theory Centre.
**FEEDBACK IN LQCP (LINEAR QUADRATIC CONTROL PROBLEM) WITH A TERMINAL INEQUALITY CONSTRAINT**
Z. Emirsajlow Mar. 1987 22 p
(PB87-220034; Rept-140) Avail: NTIS HC E04/MF E04 CSCL 12A

The linear quadratic control problem (LQCP) for systems defined by evolution operators with a terminal state inequality constraint is considered. It is shown that under suitable assumptions the optimal control exists, is unique, and has a closed loop structure. A synthesis of the feedback requires the solving of the integral Riccati equation for the unconstrained LQCP and a linear integral equation whose solution depends on a real parameter satisfying an additional condition. GRA

**N88-14677#** Technische Hogeschool, Delft (Netherlands). Onderafdeling der Wiskunde en Informatica.
**SUBCRITICAL BRANCHING PROCESSES IN A TWO STATE RANDOM ENVIRONMENT, AND A PERCOLATION PROBLEM ON TREES**
F. M. Dekking [1986] 22 p
(PB87-230439; Rept-86-18) Copyright Avail: NTIS HC A03/MF A01 CSCL 12A

The decay rate of the survival probability of subcritical branching processes in a two state random environment is determined, where one state is subcritical, the other supercritical. The result is applied to obtain the asymptotic behavior (as n tends to infinity) of the number of different words of length n occurring on the binary, and generally the b-ary, tree with Bernoulli percolation. Author

**N88-14678#** Technische Hogeschool, Delft (Netherlands). Onderafdeling der Wiskunde en Informatica.
**ANALYSIS OF A PARALLEL SOLUTION METHOD FOR TRIDIAGONAL SYSTEMS**
H. A. vanderVorst 1986 20 p
(PB87-230538; REPT-86-06) Copyright Avail: NTIS HC A03/MF A01 CSCL 12A

An alternative decomposition for a tridiagonal matrix T, is analyzed which has the property that the decomposition as well as the subsequent solution process can be done in two parallel parts. The decomposition is equivalent to a parallel variant of Gaussian elimination that was proposed by Joubert and Cloete. The computational complexity of the alternative decomposition is the same as for the standard decomposition and a remarkable aspect is that it often leads to slightly more accurate solutions than the standard process does. The algorithm can be combined with recursive doubling or cyclic reduction in order to increase the degree of parallelism and vectorizability. GRA

**N88-14679#** Technische Hogeschool, Delft (Netherlands). Onderafdeling der Wiskunde en Informatica.
**SOLUTION OF NON-SYMMETRIC LINEAR SYSTEMS BY BICONJUGATE GRADIENTS OR CONJUGATE GRADIENTS SQUARED**
E. F. Kaasschieter 1986 65 p
(PB87-226387; REPT-86-21) Copyright Avail: NTIS HC A04/MF A01 CSCL 12A

An important problem of numerical linear algebra is the solution of a set of linear equations Ax = b where A is a regular coefficient matrix. The method of biconjugate (bi-cg method) and the method of conjugate gradients squared (cgs method) are used to solve such systems. A necessary and sufficient condition is given in order that a given number of iterations of both methods is executable. Subsequently the preconditioned bi-cg and cgs methods are considered with an incomplete LU sup T-decomposition as preconditioning. Numerical experiments on three model problems for the convection-diffusion equation are discussed. At the end of the report, the listings of the FORTRAN routines BCG, CGS, BCGEIS, and CGSEIS are given. GRA

**N88-14680#** Technische Hogeschool, Delft (Netherlands). Onderafdeling der Wiskunde en Informatica.
**COMPUTATION OF FREE BOUNDARIES**
C. Cuvelier 1986 18 p
(PB87-226023; Rept-86-53) Copyright Avail: NTIS HC A03/MF A01 CSCL 12A

Problems in which the solution of a (partial) differential equation has to satisfy certain conditions on the boundary of a prescribed domain are referred to as boundary-value problems. In many cases, however, the boundary of the domain is not known in advance but has to be determined as part of the solution. The term stationary free-boundary (SFB) is commonly used when the boundary is stationary and a steady-state exists. Moving free-boundaries (MFB), on the other hand, are associated with time-dependent problems and the position of the boundary now is a function of time and space. In applications, SFB problems are usually of elliptic type, while MFB problems are often described by parabolic equations. Some numerical techniques are described for the computation of (S and M) FBs. The techniques will be explained on the basis of a simple 1-D differential equation, and will be applied to the computation of capillary free boundaries governed by the Navier-Stokes equations. GRA

**N88-14681#** Technische Hogeschool, Delft (Netherlands). Onderafdeling der Wiskunde en Informatica.
**PSEUDODIFFERENTIAL OPERATORS ON THE CIRCLE AND FINITE DIFFERENCES**
R. J. C. H. vandenDries 1986 15 p
(PB87-222352; Rept-86-37) Copyright Avail: NTIS HC A03/MF A01 CSCL 12A

Characterization of pseudodifferential operators on the circle group by means of discretely defined symbols is discussed. Extension of such operators to pseudodifferential operators on the real line is considered. GRA

**N88-14682#** Los Alamos National Lab., N. Mex.
**EIGENVALUES AND EIGENVECTORS OF FIELD TENSORS AND ASSOCIATED ENERGY TENSORS**
A. W. Turner Oct. 1987 34 p
(Contract W-7405-eng-36)
(DE88-001951; LA-11113-MS) Avail: NTIS HC A03/MF A01

The properties of symmetric and antisymmetric matrices are examined, and the existing theorems of Synge are applied to five example cases. It is found that Synge's theorems require some restatement to be generally valid. Specifically, some of Synge's theorems apply only to second-rank, four-dimensional, antisymmetric tensors having six real and six imaginary components. In addition, distinctions must be made in some of Synge's theorems between general eigenvectors and eigenvectors of the form (a sub 1, a sub 2, a sub 3, ia sub 4) where the a(sub k) are real numbers. Properties of the five example tensors are summarized, and properly restricted versions of Synge's theorems are given in the concluding section of the report. DOE

**N88-14683#** California Univ., Berkeley. Lawrence Berkeley Lab.
**A PERIODIC SMALL-CLUSTER APPROACH TO MANY-BODY PROBLEMS**
L. M. Falicov Aug. 1987 8 p Presented at the 5th International Conference on the Recent Progress in the Many-Body Theories, Oulu, Finland, 3 Aug. 1987 Prepared in cooperation with Nordisk Inst. for Teoretisk Atomfysik, Copenhagen, Denmark
(Contract DE-AC03-76SF-00098)
(DE88-002235; LBL-23894; CONF-8708158-1) Avail: NTIS HC A02/MF A01

Many-body problems can very seldom be solved exactly, and their study normally requires approximate methods. These approximations are of various kinds and accuracy, but usually they involve either a perturbation treatment, or a variational approach. The method employed also depends on whether the problem under study is a real or realistic system or a prototype, ideal model. The method proposed by the author and used with his collaborators in the solution of a variety of problems consists of taking explicit advantage of finite sampling, finite cluster duality. By a systematic, symmetric and wise choice of N points in reciprocal space, the problem can be reduced to that of a symmetric periodic cluster with N sites. If, in addition, N is small enough - as is the case in the normal handling of perturbation expansions - the problem can then be solved exactly, without recourse to perturbation methods. With the aid of group theory, only modest computer facilities are required. DOE

**N88-14684#** Cambridge Univ. (England). Dept. of Engineering.
**ASYMPTOTICALLY STABLE ALL-PASS TRANSFER FUNCTIONS: CANONICAL FORM, PARAMETRIZATION AND REALIZATION**
R. J. Ober 1986 20 p
(PB87-123972; CUED/F-CAMS/TR-262) Avail: NTIS HC E04/MF E04 CSCL 12A

Based on a canonical form for the set of minimal asymptotically stable systems in terms of balanced realizations, a parameterization is derived for the set of asymptotically stable MIMO all-pass transfer functions. A specialization of the result to the SISO case leads to a particularly simple representation of asymptotically stable scalar all-pass transfer functions. A straightforward state-space realization algorithm for asymptotically stable SISO all-pass transfer functions is given. GRA

**N88-14685#** Rome Univ. (Italy). Dipartimento di Fisica.
**DARBOUX AND BAECKLUND TRANSFORMATIONS FOR THE SCHROEDINGER EQUATION**
D. Levi 3 Mar. 1987 6 p Sponsored in part by Italian Ministry of Public Education
(Preprint-545; ETN-88-91258) Avail: NTIS HC A02/MF A01

A Darboux transformation (DT) which can be used to get q sup 0 (x) bounded asymptotically from u sup 0 (x) bounded for any g(x) (where q(x) and u(x) are terms in a potential which is a solution to the Schroedinger equation) is introduced. It is shown how to recover the DT in a generalized form using a dressing method. The DT is used to obtain explicit solutions of the Schroedinger equation. ESA

**N88-14686#** Rome Univ. (Italy). Dipartimento di Fisica.
**THE ECKHAUS PARTIAL DIFFERENTIAL EQUATION (PDE) I PSI T + PSI XX + 2(PSI/SQ)X PSI +2(/PSI/) TO THE 4TH POWER PSI = 0**
F. Calogero and S. DeLillo (Salerno Univ., Italy ) 12 Mar. 1987 53 p Sponsored in part by Italian Ministry of Public Education
(Preprint-546; ETN-88-91259) Avail: NTIS HC A04/MF A01

It is shown that the Eckhaus nonlinear evolution equation of Schroedinger type is integrable. It can be (exactly) linearized by a change of (dependent) variable. Hence, many solutions can be exhibited; several of them reveal a remarkable phenomenology, which, if one focusses on the evolution of the x-derivative of the

(squared) modulus of psi (x, t), may be described in terms of localized entities (solitons of various kinds) and of reactions among them. The Cauchy problem is also solved, for initial data whose modulus tends to finite values at both ends : /psi (+ or - inf. 0)/sq = p + or -. Solitons are present iff p+(CH110)0; their phenomenology depends sensitively on the behavior of psi (x, 0) as x tends to inifinity; and a generic initial datum psi (x, 0) yields solitons that collide only elastically (the same solitons are present in the remote past and future and they move with opposite speeds). ESA

**N88-14687#** Rome Univ. (Italy). Dipartimento di Fisica.
**EQUATIONS OF NONLINEAR SCHROEDINGER TYPE IN 1 + 1 AND 2 + 1 DIMENSIONS, OBTAINED FROM INTEGRABLE PARTIAL DIFFERENTIAL EQUATIONS (PDES)**
F. Calogero and A. Maccari 19 Mar. 1987 9 p Submitted for publication Sponsored in part by Italian Ministry of Public Education
(Preprint-548; ETN-88-91261) Avail: NTIS HC A02/MF A01

Evolution partial differential equations (PDE) of nonlinear Schroedinger type, in 1+1 and 2+1 dimensions, are obtained by an asymptotically exact technique of broad applicability, from integrable nonlinear PDEs. The model equations of nonlinear Schroedinger type are therefore integrable, and are likely to be of applicative relevance. ESA

**N88-14688#** Rome Univ. (Italy). Dipartimento di Fisica.
**RECURSION OPERATOR AND BIHAMILTONIAN STRUCTURE FOR INTEGRABLE MULTI-DIMENSIONAL LATTICES**
O. Ragnisco and P. M. Santini 2 Apr. 1987 36 p Sponsored in part by Italian Ministry of Public Education
(Preprint-552; ETN-88-91265) Avail: NTIS HC A03/MF A01

The recursion operator and the bihamiltonian structure for an integrable two-dimensional version of the Toda chain are algorithmically derived from the corresponding linear problem. The intimate relation between two dimensional theories and nonrabelian one-dimensional theories is emphasized. The analogies and differences between discrete and continuous integrable two dimensional systems are discussed. ESA

**N88-14689#** Rome Univ. (Italy). Dipartimento di Fisica.
**GENERAL SOLUTION OF CERTAIN FUNCTIONAL EQUATIONS**
M. Bruschi and F. Calogero 16 Apr. 1987 12 p Submitted for publication Sponsored by Italian Ministry of Public Education
(Preprint-554; ETN-88-91267) Avail: NTIS HC A03/MF A01

The general solutions of the functional equations: alpha (x + y)/(alpha (x) alpha (y)) = 1 + phi (x) phi (y) psi (x + y); and beta (x + y)/(beta (x) beta (y)) = gamma (x) + gamma (y) + chi (x + y) are shown. Alpha, phi, psi, and beta, gamma, chi are a priori unknown functions. The solutions are expressed in terms of Weierstrass elliptic functions. The special cases in which these reduce to elementary functions are exhibited. Remarkable formulae satisfied by Weierstrass elliptic functions are reported. ESA

**N88-14690#** Rome Univ. (Italy). Dipartimento di Fisica.
**NONISOSPECTRAL DEFORMATIONS AND DARBOUX TRANSFORMATIONS FOR THE 3RD ORDER SPECTRAL PROBLEM**
D. Levi and O. Ragnisco 7 May 1987 12 p
(Preprint-558; ETN-88-91271) Avail: NTIS HC A03/MF A01

The class of nonlinear partial differential equations obtainable as nonisospectral deformations of the third order spectral problem, when the spectral parameter depends both on x and t is presented. Among these equations is the cylindrical Boussinesq equation. Through the construction of four different Darboux transformations, the simplest soliton solution for the whole class and its reductions is derived. ESA

**N88-14691#** Rome Univ. (Italy). Dipartimento di Fisica.
**NONLINEAR EVOLUTION EQUATIONS, RESCALINGS, MODEL PARTIAL DIFFERENTIAL EQUATIONS (PDES) AND THEIR INTEGRABILITY, 2**
Francesco Calogero and Wiktor Eckhaus 21 May 1987 24 p Submitted for publication
(Preprint-560; ETN-88-91273) Avail: NTIS HC A03/MF A01

The model equations that govern the wave modulations induced by weakly nonlinear effects are investigated in the context of nonlinear evolution equations in 1+1 dimensions having a dispersive linear part. Evolution equations with an even linear part (namely, with a linear part that features only derivatives of even order) are emphasized. It is shown how to relate the two classes of nonlinear evolution equations with even and odd linear parts. ESA

**N88-14692#** Rome Univ. (Italy). Dipartimento di Fisica.
**DARBOUX TRANSFORMATION AND SPECIAL SOLUTIONS FOR THE TWO-DIMENSIONAL TODA-LATTICE**
Z. Popowicz and O. Ragnisco 3 Jul. 1987 7 p Sponsored in part by Italian Ministry of Public Education
(Preprint-562; ETN-88-91275) Avail: NTIS HC A02/MF A01

A Darboux transformation for the 2+1-dimensional integrable Toda lattice is derived. It is used to construct the one-soliton solution. ESA

**N88-14693#** Rome Univ. (Italy). Dipartimento di Fisica.
**NONLINEAR RELAXATION AND ERGODICITY BREAKDOWN IN RANDOM ANISOTROPY SPIN GLASSES**
S. Ciuchi and F. dePasquale (Aquila Univ., Italy ) 13 Jul. 1987 56 p
(Preprint-565; ETN-88-91277) Avail: NTIS HC A04/MF A01

An exact theory of the nonlinear relaxation of a zero dimensional magnetic anisotropy model is derived in the large n-limit where n is the number of the spin components. The pure and random cases are treated. In the random case the magnetization decays asymptotically with an inverse time power. This result is shown to agree with the numerical solution of the model in the case of a large but finite n. An ergodicity breaking phenomenon associated with the nonlinear relaxation in the spin glass which occurs even in the absence of replica symmetry breaking in the steady state is found. ESA

**N88-14694#** Vrije Universiteit, Amsterdam (Netherlands). Subfaculteit Wiskunde en Informatica.
**STABILIZED GALERKIN METHOD FOR CONVECTION-DIFFUSION PROBLEMS**
P. P. N. deGroen and M. vanVeldhuizen Dec. 1986 35 p
(PB87-234985; Rept-320) Avail: NTIS HC A03/MF A01
CSCL 12A

A new method for the solution of convection dominated diffusion equations is described. The method is based on the idea that the symmetric Galerkin finite element discretization can be stabilized by a suitable extension of the test space. The resulting overdetermined system is solved in least squares sense using the normal equations. The resulting discretization is derived by a conforming method and yields a symmetric system of equations. It shows a resemblance to the (non-conforming) streamline upwind/Petrov-Galerkin method. The results of the new stabilized Galerkin method have a comparable accuracy. Author

**N88-14695#** Utrecht State Univ. (Netherlands). Dept. of Computer Science.
**DISTRIBUTED INFIMUM APPROXIMATION**
G. Tel Aug. 1986 26 p
(PB87-234969; RUU-CS-86-12) Avail: NTIS HC A03/MF A01
CSCL 12A

Distributed Infimum Approximation (DIA) is defined as an abstraction of several interesting problems in the field of distributed computing. Global Virtual Time approximation as well as Distributed Termination Detection are special cases of DIA. Solutions to the DIA problem are given for different communication models that can be implemented elegantly on various subtopologies. Author

**N88-14696#** Pittsburgh Univ., Pa. Center for Multivariate Analysis.
**STRONG CONSISTENCY OF M-ESTIMATES FOR THE LINEAR MODEL**

X. R. Chen and Yeuhua Wu Jul. 1987 19 p
(Contract F49620-85-C-0008)
(AD-A185487; TR-87-24; AFOSR-87-0971TR) Avail: NTIS HC A03/MF A01 CSCL 12A

Let (sub 1),...,(sub n),... be i.i.d. observations of a random vector (X,Y) where Y is one-dimensional and X may be multi-dimensional. Suppose that the regression of Y to X, in some sense, is a linear function alpha sub o + beta sub o. It is desired to estimate the unknown parameters alpha sub o, beta sub o, using the observations (sub 1),...(sub n,). A much discussed class of estimates is the so-called M-estimate, which takes the solution of a certain minimization problem as the estimator. Here rho is a properly selected function defined over R' = (infinity). GRA

**N88-14697#** Maryland Univ., College Park. Dept. of Mathematics.
**HOC SPECTRAL ANALYSIS OF AN ALMOST PERIODIC RANDOM SEQUENCE IN NOISE**
Shuyuan He and Benjamin Kedem May 1987 35 p
(Contract N00014-86-K-0007; Grant AF-AFOSR-0187-82)
(AD-A185528; MD87-24-BK/SH; TR87-24; AFOSR-87-1138TR)
Avail: NTIS HC A03/MF A01 CSCL 12A

Under some conditions, the expected numbers of zero-crossings observed in a finite section of a process with a mixed spectrum and in finite sections of its filtered versions, determine the frequencies in the discrete spectrum regardless of the magnitude of the noise component. Author (GRA)

**N88-14698#** Clarkson Univ., Potsdam, N.Y. Dept. of Mathematics and Computer Science.
**EIGENVECTORS OF GRAPHS**
1987 7 p
(Contract N00014-85-K-0497)
(AD-A185538) Avail: NTIS HC A02/MF A01 CSCL 12A

This work considered the rows of an eigematrix of a distance-regular graph as coordinates of points in space. Geometric and algebraic properties and relations for these points are found that correspond to graph-theoretic properties of the corresponding vertices. Some properties and relations considered are automorphisms, proximity, linear dependence and independence, and facets of the convex hull. Author (GRA)

**N88-14699#** North Carolina Univ., Chapel Hill. Center for Stochastic Processes.
**ON THE RELATIONS BETWEEN INCREASING FUNCTIONS ASSOCIATED WITH TWO-PARAMETER CONTINUOUS MARTINGALES**
D. Nualart, M. Sanz, and M. Zakai Jun. 1987 28 p
(Contract F49620-85-C-0144)
(AD-A185572; TR-190; AFOSR-87-1103TR) Avail: NTIS HC A03/MF A01 CSCL 12A

Let M be a two-parameter continuous martingale bounded in L squared and null on the axes. The positive submartinggale M squared has a Doob-Meyer decomposition. The purpose of this paper is to relate the measures induced by certain quadratic variations in terms of the absolute continuity property. Since we are dealing with random measures, different definitions are possible. GRA

**N88-14700#** Ford Aerospace and Communications Corp., Palo Alto, Calif.
**DIFFUSION FIRST PASSAGE TIMES: APPROXIMATIONS AND RELATED DIFFERENTIAL EQUATIONS**
Michael L. Wenocur 1986 27 p
(Contracts F49620-86-C-0022; DAAG29-82-K-0151)
(AD-A185592; AFOSR-87-1370TR) Avail: NTIS HC A03/MF A01 CSCL 12A

THis paper is primarily concerned with computing first passage time statistics. In previous work a general reliability model was proposed in which system failures occur when either system wear-and-tear reaches some maximum permissible level (ie, a first passage occurs), or when some killing event happens (such killing events occur with rate k(x) in state x). Under this model w(x,t) satisfies the a certain equation; it is possible to solve for w)x,t) and related quantities with methods very similar to those presented here. In Section 2, algorithms for approximating w(x,t) are obtained. In particular, the infinite spectral expansion for w(x,t) is approximated by an n-term sub-expansion which matches the first n-1 moments. Section 2 concludes with some remarks about out preliminary computational experience. In Sections 3 and 4, methods are given for obtaining the eigenvalues and first passage moments necessary for computing approximations to w(x,t). In Section 5, computational issues related to calculating the moment generating function are considered. Section 6 and 7 include theoretical complements atout first passage times. GRA

**N88-14701#** New York Univ., New York. Inst. of Mathematical Sciences.
**THE INVERSE BACK SCATTERING PROBLEM FOR THE SCHROEDINGER EQUATION IN TWO SPACE DIMENSIONS Interim Report**
Cathleen S. Morawetz 1 Apr. 1987 27 p
(Contract N00014-85-K-0195)
(AD-A185603) Avail: NTIS HC A03/MF A01 CSCL 12A

This paper is concerned with determining a potential q(x) for the steady state Schroedinger equation in two space variables, x = (x1, x2): (1.1) (Delta + omega 2 - q) u = 0. It is assumed there are no bound states. The data come from the far field scattered by plane waves impinging in a range of directions but measured only in the opposite directions. More precisely let p(e, omega, x) be a solution of (1.1) which for e.x = - infinity behaves like e x p(-i omega e.x) plus a scattered wave behaving like e x p (i omega e.x). Here e is a unit vector. Clearly this requires some conditions of decay on q. GRA

**N88-14702#** Southern Methodist Univ., Dallas, Tex. Dept. of Mathematics.
**VARIATION OF WAVE ACTION: MODULATIONS OF THE PHASE SHIFT FOR STRONGLY NONLINEAR DISPERSIVE WAVES WITH WEAK DISSIPATION. A NEW ADIABATIC INVARIANT INVOLVING THE MODULATED PHASE SHIFT FOR STRONGLY NONLINEAR, SLOWLY VARYING, AND WEAKLY DAMPED OSCILLATORS. THE MODULATED PHASE SHIFT FOR WEAKLY DISSIPATED NONLINEAR OSCILLATORY WAVES OF THE KORTEWEG-DE VRIES TYPE**
F. J. Bourland and Richard Haberman 25 Sep. 1987 84 p
(Grant AF-AFOSR-0134-87)
(AD-A185630; AFOSR-87-1569TR) Avail: NTIS HC A05/MF A01 CSCL 12A

The equations for the spatial and temporal modulations of the phase shift for solowly variying strongly nonlinear oscillators and dispersive waves have been determined for the first time. The effects of dissipative perturbations have been investigated for nonlinear oscillatory solutions of ordinary and partial differential equations (described by Klein-Gordon and Korteweg-de Vries type equations). The phase exact action equation, a somewhat simpler technique than the usual elimination of secular terms at an even higher order in the asymptotic expansion. It has been shown that, for dissipative perturabions, the frequency and action equations are valid to higher order and that their variations are only due to perturbations in the wave number and the averaged amplitude parameters. for second-order ordinary differential equations, the phase shift is determined from initial conditions in straight-forward manner since it was shown that there exists a new adiabatic invariant. GRA

**N88-14703#** Brown Univ., Providence, R. I. Div. of Applied Mathematics.
**A UNIFIED MATHEMATICAL APPROACH TO IMAGE ANALYSIS Final Technical Report, 1 Sep. 1983 - 30 Apr. 1987**
Stuart Geman, Donald Geman, Donald E. McClure, and Ulf Grenander 31 Aug. 1987 56 p
(Contract DAAG29-83-K-0116)
(AD-A185719; ARO-20551.4-MA) Avail: NTIS HC A04/MF A01 CSCL 12A

This report describes a unified approach to the mathematical modelling and statistical analysis of pictures. The results reported here were derived from the research project Nonparametric Estimation by the Model of Sieves supported by the U.S. Army Research Office, Contract DAAG29-83K-0116 to Brown University. Early in the project, the investigations focused on the estimation of (properties of) digitized images; this focus was a natural extension of our earlier work on the method of sieves of regularizing statistical estimates of infinite dimensional objects and the groundwork that had been laid for General Pattern Theory. The present report presents the Bayesian paradigm for mathematical modeling and analysis of digital images and then describes four instances of the paradigm in detail. Directions for ongoing and future research are also indicated. GRA

**N88-14704#** Minnesota Univ., Duluth. Dept. of Mathematics and Statistics.
**LOCAL AND GLOBAL TECHNIQUES FOR THE TRACKING OF PERIODIC SOLUTIONS OF PARAMETER-DEPENDENT FUNCTIONAL DIFFERENTIAL EQUATIONS Final Report, 1 Mar. 1986 - 30 Apr. 1987**
Harlan W. Stech 30 Apr. 1987 29 p
(Grant AF-AFOSR-0071-86)
(AD-A185756; AFOSR-87-1575TR) Avail: NTIS HC A03/MF A01 CSCL 12A

This project initiated various aspects of an ongoing study of numerical/analytic techniques for the identification of periodic solutions to functional differential equations. The techniques developed apply to very general classes of equations, and have been implemented on a variety of specific model problems. Local techniques refer to methods that apply to the problem of analyzing the Hopf bifurcation structure of small periodic orbits of multiparameter systems. A FORTRAN code, BIFDE, was written to analyze generic bifurcations of general systems with infinite delay. Global tracking methods have been developed to study the growth and parameter dependence of global Hopf bifurcations. Investigations have centered on the development of spine-based approximation techniques and their implementation in a FORTRAN code FDETRAK. GRA

**N88-14705#** Naval Postgraduate School, Monterey, Calif.
**CHARACTERISTIC TRAJECTORIES OF GENERALIZED LANCHESTER EQUATIONS Technical Report, 1 Oct. 1985 - 1 Jun. 1987**
John M. Wozencraft and Paul H. Moose Jun. 1987 62 p
(AD-A185762; NPS-62-87-014) Avail: NTIS HC A04/MF A01 CSCL 12A

Generalized Lanchester-type differential equations are used to model attrition processes. This system of non-linear equations has multiple equilibrium solutions, which can be determined by a numerical technique called the Continuation Method when the problem's dimensionality is moderate. System dynamics are investigated and shown to depend critically on a domain of attraction defined by a tube which connects the non-negative equilibrium points and contains the dominant eigenvector at those points. Principles are presented and illustrated for mapping NM-dimensional systems into equivalent two-dimensional systems. This capability is especially important when aggregating subsystems have only four mapping NM-dimensional systems into equivalent two-dimensional systems. This capability is especially important when aggregating subsystems in multi-level systems modeling. It is shown that the two-dimensional Lanchester systems have only four distinct modes of behaviour, depending on the number of real positive equilibrium points that they have. A method is described and illustrated for reallocating attrition as state variables approach zero in order to guarantee their non-negativity. GRA

**N88-14706#** Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
**SHADOW SYSTEMS AND ATTRACTORS IN REACTION-DIFFUSION EQUATIONS**
Jack K. Hale and Kunimochi Sakamoto Apr. 1987 30 p
(Contracts DAAL03-86-K-0074; AF-AFOSR-84-0376)
(AD-A185804; LCDS/CCS-87-28; AFOSR-87-1526TR) Avail: NTIS HC A03/MF A01 CSCL 12A

For a pair of reaction diffusion equations with one diffusion coefficient very large, there is associated a reaction diffusion equation coupled with an ordinary differential equation (the shadow system) with nonlocal effects which has the property that it contains all of the essential dynamics of the original equations. GRA

**N88-14707#** Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
**EXISTENCE AND STABILITY OF TRANSITION LAYERS**
Jack K. Hale and Kunimochi Sakamoto Apr. 1987 61 p
(Contracts DAAL03-86-K-0074; AF-AFOSR-84-0376)
(AD-A185806; LCDS/CCS-87-27; AFOSR-87-1525TR) Avail: NTIS HC A04/MF A01 CSCL 12A

For a second order nonautonomous singularly perturbed ordinary differential equation with Neumann boundary conditions, the existence of single transition layer solutions is proved by using the method of Liapunov-Schmidt. The method also gives the stability of these solutions as an equilibrium point of a parabolic equation. GRA

**N88-14708*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**ROUND-OFF ERROR PROPAGATION IN FOUR GENERALLY APPLICABLE, RECURSIVE, LEAST-SQUARES-ESTIMATION SCHEMES**
M. H. Verhaegen Dec. 1987 27 p
(NASA-TM-100055; A-88050; NAS 1.15:100055) Avail: NTIS HC A03/MF A01 CSCL 12A

The numerical robustness of four generally applicable, recursive, least-squares-estimation schemes is analyzed by means of a theoretical round-off propagation study. This study highlights a number of practical, interesting insights of widely used recursive least-squares schemes. These insights have been confirmed in an experimental study as well. Author

**N88-14709*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**IMPROVED UNDERSTANDING OF THE LOSS-OF-SYMMETRY PHENOMENON IN THE CONVENTIONAL KALMAN FILTER**
M. H. Verhaegen Dec. 1987 14 p Submitted for publication
(NASA-TM-100041; A-88024; NAS 1.15:100041) Avail: NTIS HC A03/MF A01 CSCL 12A

This paper corrects an unclear treatment of the conventional Kalman filter implementation as presented by M. H. Verhaegen and P. van Dooren in Numerical aspects of different Kalman filter implementations, IEEE Trans. Automat. Contr., v. AC-31, no. 10, pp. 907-917, 1986. It is shown that habitual, incorrect implementation of the Kalman filter has been the major cause of its sensitivity to the so-called loss-of-symmetry phenomenon. Author

**N88-14710#** Utrecht State Univ. (Netherlands). Dept. of Computer Science.
**SCANLINE ALGORITHMS ON A GRID**
R. G. Karlsson and M. H. Overmars Oct. 1986 19 p
(PB88-103379; RUU-CS-86-18) Avail: NTIS HC A03/MF A01 CSCL 12A

A number of important problems in computational geometry are solved efficiently on 2- or 3-dimensional grids by means of scanline techniques. In the solutions to the maximal elements and closure problems, a factor log n is substituted by loglog u, where n is the set size and u the grid size. Next, by using a data structure introduced in the paper, the interval trie, previous solutions to the rectangle intersection and connected component problems are improved upon. Finally, a fast intersection finding algorithm for arbitrarily oriented line segments is presented. The methods presented should be useful within computer graphics, VLSI design, and robotics. GRA

**N88-14711#** Vrije Universiteit, Amsterdam (Netherlands). Subfaculteit Wiskunde en Informatica.
**NORMAL FORM OF A FULLY RESONANT HAMILTONIAN FUNCTION**
A. Fekken Sep. 1986 38 p
(PB88-100946; Rept-317) Avail: NTIS HC A03/MF A01 CSCL 12A

The authors investigate the (algebraic) structure of fully resonant Hamiltonian functions in Birkhoff-Gustavson normal form. It is proved that when such an Hamiltonian is truncated to a polynomial of some degree, it can be written as a finite linear combination of polynomials with a finite set of generators as variables and coefficients. This set of generators depends on the quadratic part of the Hamiltonian only and is not unique; the polynomials, however, are unique for a given set of generators. Because of this unicity, our theorem extends a classical lemma by Gordan. The proof consists of a description of an algorithm to compute such a set of generators. The results are partially checked by computing the Poincare series for the genuine first and second order resonances in three degrees of freedom. GRA

**N88-14712#** Vrije Universiteit, Amsterdam (Netherlands). Subfaculteit Wiskunde en Informatica.
**TOPOLOGICAL EQUIVALENCE OF CERTAIN FUNCTION SPACES 2**
J. Baars, J. deGroot, and J. vanMill Dec. 1986 25 p
(PB88-100904; Rept-321) Avail: NTIS HC A03/MF A01 CSCL 12A

Let X be a countable metric space which is not locally compact. It is proved that the function space (C sub p)(X) is homeomorphic to sigma sub omega. GRA

**N88-14713#** Vrije Universiteit, Amsterdam (Netherlands). Subfaculteit Wiskunde en Informatica.
**EMBEDDING TOPOLOGICAL MEDIAN ALGEBRAS IN PRODUCTS OF DENDRONS**
H. J. Bandelt Nov. 1986 36 p
(PB88-100888; Rept-318) Avail: NTIS HC A03/MF A01 CSCL 12A

Dendrons and their products admit a natural, continuous median operator. It is proved that there exists a two-dimensional metric continuum with a continuous median operator, for which there is no median-preserving embedding on a product of finitely many dendrons. The method involves ideas and results concerning graph coloring and abstract convexity. The main result answers a question in another paper negatively, and is sharply contrasting with a result of Stralka on embeddings of compact lattices. GRA

**N88-14238#** Finnish Meteorological Inst., Helsinki. Div. of Geomagnetism.
**THE SOLUTION OF LARGE LINEAR INVERSE PROBLEMS**
Markku S. Lehtinen *In* Oulu Univ., Report of the 3rd Finnish EISCAT Workshop Mar. 1987 p 41-49 (For primary document see N88-14233 06-32)
Avail: NTIS HC A05/MF A01

**N88-14863*#** Prairie View Agricultural and Mechanical Coll., Tex. Dept. of Mechanical Engineering.
**SHUTTLE COMPUTATIONAL GRID GENERATION Final Report**
Chang Ing *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 19 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 19 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 12A

# 65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

**N88-14714*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**A NEW METHOD OF BOUNDARY PARAMETER ESTIMATION FOR A TWO-DIMENSIONAL DIFFUSION SYSTEM UNDER NOISY OBSERVATIONS Final Report**
Y. Sunahara (Kyoto Inst. of Tech., Japan ) and F. Kojima Nov. 1987 29 p Presented at the 10th IFAC World Congress on Automatic Control, Munich, Fed. Republic of Germany, 1987
(Contract NAS1-18107)
(NASA-CR-178405; ICASE-87-72; NAS 1.26:178405) Avail: NTIS HC A03/MF A01 CSCL 12A

The purpose of this paper is to establish a method for identifying unknown parameters involved in the boundary state of a class of diffusion systems under noisy observations. A mathematical model of the system dynamics is given by a two-dimensional diffusion equation. Noisy observations are made by sensors allocated on the system boundary. Starting with the mathematical model mentioned above, an online parameter estimation algorithm is proposed within the framework of the maximum likelihood estimation. Existence of the optimal solution and related necessary conditions are discussed. By solving a local variation of the cost functional with respect to the perturbation of parameters, the estimation mechanism is proposed in a form of recursive computations. Finally, the feasibility of the estimator proposed here is demonstrated through results of digital simulation experiments.
Author

**N88-14715#** Technische Hogeschool, Delft (Netherlands). Onderafdeling der Wiskunde en Informatica.
**VON MISES' DEFINITION OF RANDOM SEQUENCES RECONSIDERED**
M. vanLambalgen [1986] 43 p
(PB87-230512; Rept-86-12) Copyright Avail: NTIS HC A03/MF A01 CSCL 12A

Attempts to define random sequences are reviewed briefly. These attempts suggest two theorems: one concerning the number of subsequence selection procedures that transform a random sequence into a random sequence; the other concerning the relationship between definitions of randomness based on subsequence selection and those based on statistical tests.
Author

**N88-14716#** Pittsburgh Univ., Pa. Center for Multivariate Analysis.
**TESTING AND INTERVAL ESTIMATION IN A CHANGE-POINT MODEL ALLOWING AT MOST ONE CHANGE**
Xiru Chen Jul. 1987 29 p
(Contract F49620-85-C-0008)
(AD-A185525; TR-87-25; AFOSR-87-0972TR) Avail: NTIS HC A03/MF A01 CSCL 12A

This paper considers the simplest model of change-point in which at most one change in the mean may occur. Results include: 1) Introduction of a test for the null hypothesis that no change in the mean occurs, and the limit distribution of the test-statistic; 2) Approximate calculation of the power of the test; 3) Interval estimation of the position of change; 4) Point estimation of the jump at the point of change and its asymptotic distribution; and 5) Evaluation of the bias of the MLE of error variance.
Author (GRA)

**N88-14717#** Pittsburgh Univ., Pa. Center for Multivariate Analysis.
**ON DETECTION OF CHANGE POINTS USING MEAN VECTORS**
P. R. Krishnaiah, B. Q. Miao, and L. C. Zhao Dec. 1986 30 p
(Contract F49620-85-C-0008)
(AD-A185581; TR-86-41; AFOSR-87-1020TR) Avail: NTIS HC A03/MF A01 CSCL 12A

The problem of change points within the framework of model selection procedures using information theoretic criteria is

considered. Procedures are proposed for estimation of the locations of change points and the number of change points. The strong consistency of these procedures is also established. Also, the problem of change points is discussed within the framework of the simultaneous test procedures. Author (GRA)

**N88-14718#** Pittsburgh Univ., Pa. Center for Multivariate Analysis.
**LOCAL LIKELIHOOD METHOD IN THE PROBLEMS RELATED TO CHANGE POINTS**
P. R. Krishnaiah, B. Q. Miao, and L. C. Zhao Jun. 1987 4 p
(Contract F49620-85-C-0008)
(AD-A185604; TR-87-22; AFOSR-87-0975TR) Avail: NTIS HC A02/MF A01 CSCL 12A

In this paper, the so-called local likelihood method is suggested for solving the change point problems when the data are distributed as multivariate normal. The detection procedures proposed not only provide strongly consistent estimates for the number and locations of the change points, but also simplify significantly the computation. Author (GRA)

**N88-14719#** Sloan-Kettering Inst. for Cancer Research, New York.
**ASYMPTOTIC NORMALITY OF POLY-t DENSITIES WITH BAYESIAN APPLICATIONS Technical Report, 1 Sep. 1985 - 1 Aug. 1987**
George Y. Wong 1 Oct. 1987 23 p
(Contract N00014-85-K-0485)
(AD-A185718; ONR-87-1) Avail: NTIS HC A03/MF A01 CSCL 12A

A poly-t density is a density which is proportional to a product of at least two t-like factors, each of which is of a certain form where d is a positive number, micron (underlined) is an arbitrary location vector and M (underlines) is a symmetric semi-positive definite scale matrix. In general, M (underlines) is a function of d. Such a density arises, for example, in the Bayesian analysis of a linear model with a normal error term, independent normal priors on the linear parameters and inverted-gamma priors on the variance components. A theorem about the asymptotic normality of the density as a subset of the individual d's tend to infinity is proved under very general conditions. A corollary is specifically related to the Bayesian linear regression model with two variance components. The Tiao-Zellner expansion for approximating the particular poly-t form involving two proper multivariate t factors is extended to the case of two arbitrary t-like factors. GRA

**N88-14720#** Florida State Univ., Tallahassee. Dept. of Statistics.
**A THREE-PARAMETER GENERALISATION OF THE BETA-BINOMIAL DISTRIBUTION WITH APPLICATIONS**
Peter J. Danaher Jul. 1987 21 p
(Contract F49620-85-C-0007; Grant AF-AFOSR-0007-85)
(AD-A185733; FSU-STATISTICS-M760; TR-87-208; AFOSR-87-1041TR) Avail: NTIS HC A03/MF A01 CSCL 12A

A three-parameter generalization of the beta-binomial distribution (BBD) is derived and examined. The author obtains the maximum likelihood estimates of the parameters and show that the regularity conditions for asymptotic efficiency are satisfied. To exhibit the applicability of the generalized distribution it is shown how it gives an improved fit over the BBD for magazine exposure and consumer purchasing data. Finally an empirical Bayes estimate of a binomial proportion based on the generalized beta distribution used in this study is derived. GRA

**N88-14721#** Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
**STOCHASTIC APPROXIMATION AND LARGE DEVIATIONS: GENERAL RESULTS FOR W.P.1. CONVERGENCE**
Paul Dupuis and Harold J. Kushner Feb. 1987 65 p
(Contracts N00014-83-K-0542; AF-AFOSR-85-0315; DAAG29-84-K-0082; Grants NSF DMS-85-11470; NSF ECS-85-05674)
(AD-A185818; LCDS/CCS-87-21; AFOSR-87-1528TR) Avail: NTIS HC A04/MF A01 CSCL 12A

W.p.1. convergence results are obtained for stochastic recursive approximation algorithms under very general conditions. The gain sequence (a sub n) can go to zero very slowly and state-dependent noise, discontinuous dynamical equations and the projected or constrained algorithm are all treated. The basic technique is the theory of large deviations. Prior results obtained via this theory are extended in many directions. GRA

# 66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

**N88-14722#** Lawrence Livermore National Lab., Calif.
**STRATEGIC DEFENSE INITIATIVE ORGANIZATION/DARPA (DEFENSE ADVANCED RESEARCH PROJECTS AGENCY) WORKSHOP ON LASER PROPULSION. VOLUME 1: EXECUTIVE SUMMARY**
J. T. Kare, ed. Nov. 1986 19 p Presented at the SDIO/DARPA Workshop on Laser Propulsion, Livermore, Calif., 7 Jul. 1986
(Contract W-7405-eng-48)
(DE87-003254; CONF-860778-Vol-1) Avail: NTIS HC A03/MF A01

The primary charter of the Workshop was to consider the design of ground-to-orbit launch systems (as opposed to, e.g., orbit-changing propulsion). The first three days of the Workshop were devoted to talks on various aspects of laser propulsion and related areas such as FELs; an overview of these talks is presented in the following section. The remainder of the Workshop was devoted largely to discussions of specific issues in the design of laser-energized thrusters and laser launch systems. The development of any type of laser propulsion would significantly expand the range of feasible space missions. Several types of laser propulsion are thus mentioned herein, and work on all types of laser thrusters is recommended. True low-cost access to space, however, will require a laser launching system that is as simple and robust as possible. To this end, this summary emphasizes the extremely simple detonation-wave thruster concept, defined originally by Dennis Reilly and in its current form by Arthur Kantrowitz, on which the latter part of the Workshop concentrated. DOE

**N88-14723#** Research Inst. of National Defence, Stockholm (Sweden).
**LAND CAMPAIGN FORCE ASSESSMENT. METHODS USED IN CENTRAL-EUROPE-STUDY**
Avddir Helge Loefstedt Jun. 1987 50 p In SWEDISH; ENGLISH summary
(FOA-C-10288-9.3; ISSN-0281-0247; ETN-88-90742) Avail: NTIS HC A03/MF A01; Research Institute of National Defence, Stockholm, Sweden KR 50

It is shown how weapon systems in a land campaign were aggregated. Ground attack, helicopters, and attack aircraft are treated as well as land combat units. The efficiency of different types of attack aircraft and combat vehicles is compared. Losses and cessation of combat are discussed. Computer models are given for the actualization of the total combat value of an unit. ESA

**N88-14873*#** Washington Univ., Seattle. Dept. of Mechanical Engineering.
**INVENTORY BEHAVIOR AT REMOTE SITES Final Report**
William C. Lewis, Jr. *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 24 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 24 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 12B

# 67 THEORETICAL MATHEMATICS

Includes topology and number theory.

**N88-14724#** Technische Hogeschool, Delft (Netherlands). Onderafdeling der Wiskunde en Informatica.
**CLASS OF N-ASSOCIATIVE RINGS**
A. H. Boers 1986 97 p
(PB87-230421; REPT-86-03) Copyright Avail: NTIS HC A05/MF A01 CSCL 12A

The monograph comprises the investigation of a class of nonassociative rings and algebras. A number of results, obtained in the course of the past decades, dispersed over several papers, are collected in this study. Many results had to be improved, smoothed, and completed. The chapter headings are as follows: preliminaries; the generalized associator; n-associative rings; (n,k)-associative rings; n-alternative rings; n-PA rings; n-PAlt rings; (n,k)-PA rings; and subrings and ideals in nonassociative rings.
GRA

**N88-14725#** Technische Hogeschool, Delft (Netherlands). Onderafdeling der Wiskunde en Informatica.
**THERE EXISTS A C SUP INFINITY SYMBOL KUPKA-SMALE DIFFEOMORPHISM OF S SUP 2 WITH NEITHER SINKS NOR SOURCES**
J. M. Gambaudo, S. vanStrien, and C. Tresser 1986 35 p
(PB87-225967; Rept-86-43) Copyright Avail: NTIS HC A03/MF A01 CSCL 12A

The existence of C sup infinity symbol Kupka-Smale diffeomorphisms on S sup 2 with no periodic sinks or sources is proved. The complete answer is obtained to the question raised by Smale in 1962. Previously, R. Bowen, J. Fanks, and L. S. Young constructed C sup 2 examples. As a byproduct of the authors method, the first examples of C sup infinity symbol diffeomorphisms which are both at the accumulation of a cascade of period doubling bifurcations and at the boundary of Morse-Smale systems, are achieved. It is shown that all these maps have a non-wandering set which is conjugate to the non-wandering set of the corresponding one-dimensional map.
GRA

**N88-14726#** Amsterdam Univ. (Netherlands). Dept. of Computer Science.
**DIAGONALISATION METHODS IN POLYNOMIAL SETTING**
L. Torenvliet and P. vanEmde Boas Mar. 1986 21 p Presented at the Structure in Complexity Theory Conference, Berkeley, Calif., 2-5 Jun. 1986
(PB87-138616; FVI-86-10) Avail: NTIS HC E03/MF E01 CSCL 12A

An overview is presented of diagonalization methods which have been used for the construction of oracle sets relative to which complexity classes in the P-Time Hierarchy are separated structurally. A comparison of the methods is made on the basis of inherent properties. A characterization of these properties leads to a first attempt for a taxonomy for these diagonalization methods.
GRA

# 70 PHYSICS (GENERAL)

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics.*

**N88-14727#** Joint Publications Research Service, Arlington, Va.
**JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: PHYSICS AND MATHEMATICS Abstracts Only**
25 Jun. 1987 78 p Transl. into ENGLISH from various Russian articles
(JPRS-UPM-87-008) Avail: NTIS HC A05/MF A01

Summaries of articles from the open literature are presented in the following areas: acoustics; crystals, laser glasses, and semiconductors; fluid dynamics; lasers; nuclear physics; optics and spectroscopy; plasma physics; technical physics; theoretical physics; and algorithms and numerical methods. For individual titles, see N88-14728 through N88-14760.

**N88-14728#** Joint Publications Research Service, Arlington, Va.
**NONLINEAR REFLECTION OF SOUND WAVE IN GAS MIXTURE Abstract Only** c71
A. M. Dykhne and S. V. Pokrovskiy *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 1 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 92, no. 1, Jan. 1987 p 87-96 Original language document was announced in IAA as A87-34369 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

Propagation of sound through a mixture of light gas and heavy gas is examined for the possibility of total reflection as a result of energy transfer from incident wave to reflected wave during their nonlinear interaction. The binary gas mixture is assumed to consist of a light component and a much heavier one in approximately equal concentrations so that it contains many light molecules and relatively few heavy ones. Thermal diffusion is then negligible and pressure diffusion becomes anomalously intense. Heat conduction and viscous friction are taken into account. The problem is analyzed first by calculation of damping within the gas volume and at the container walls in the linear approximation of gas dynamics and then according to a nonlinear theory which yields quasi-static beats, assuming that the frequencies of two interacting waves are close. Equations describing buildup of a slowly varying amplitude are derived, considering that a reflected wave can be either amplified or attenuated by nonlinear interaction with a quasi-static one. Theoretical calculations are supplemented with numerical estimates pertaining to sound waves in a long cylindrical tube with H2 and SF6.
Author

**N88-14729#** Joint Publications Research Service, Arlington, Va.
**USE OF LASERS WITH F SUB A(II)-COLOR CENTER KCl:Li CRYSTALS IN THE INTRARESONATOR LASER SPECTROSCOPY METHOD Abstract Only** c36
V. M. Bayev, V. P. Dubov, A. N. Kireyev, E. A. Sviridenkov, D. D. Toptygin, and O. I. Yushchuk *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 2 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 8, Aug. 1986 p 1708-1710 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

The possibility was experimentally studied of using F sub A(II)-color centers in KCl:Li crystals for the intraresonator spectroscopy method in the visible and near IR range for the study of atmospheric gases with pumping by a continuous argon laser. The mechanism is described for the formation of the F sub A(II) centers in the crystal which involves the additive staining of the crystal by means of K vapor at 400 to 800 C and the formation of agglomerated double centers. The active element consists of polished dyed crystals 1.5 by 1 by 4 mm which is thermally treated and irradiated so that the holes are linked to the lithium atoms and the temperature is then dropped to that of liquid nitrogen. A block diagram and description is given of the experimental resonator with a cryostat containing the crystal. Pumping is by a Spectra Physics 371 argon laser. The lasing pulse repeated the pump pulse and the average length was 0.5 to 1 ms. The device had a sensitivity of s(1/10,000,000) per cm. An intraresonator absorption spectrum is given for the atmosphere (with the wavenumber range 3788 to 3793/cm) showing lines for water vapor and CO2.
Author

**N88-14730#** Joint Publications Research Service, Arlington, Va.
**OBSERVATION OF INSTABILITIES IN TIME DURING DYNAMIC SELF-DIFFRACTION OF LIGHT IN ANISOTROPIC NON-HOMOGENEOUS MEDIUM Abstract Only** c74
R. B. Alaverdyan, S. M. Arakelyan, A. S. Karayan, and Yu. S. Chilingaryan *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 4 Transl. into ENGLISH from Pisma v Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 13, no. 2, 26 Jan. 1987 p 119-123 (For primary

document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

An experiment was performed for recording oscillations in nematic liquid crystals during propagation through them of variously polarized light with attendant self-diffraction. Homeotropically oriented 5TsB crystals, also MBBA crystals in a hybrid cell with one face homeotropic and the other plane, were reoriented by a light beam from an Ar(+) laser (lambda = 0.51 micron wavelength). Measurements were made on the basis of the characteristic aberration pattern and with a weak probing light beam from a He-Ne laser (lambda = 0.63 micron wavelength). These measurements have yielded the dependence of the oscillation period on the intensity of linearly polarized light with an obliquely incident o-wave during threshold reorientation of the crystal and the dependence of the threshold light intensity on the ellipticity of polarization, linear polarization corresponding to zero ellipticity, in the case of a normally incident light beam. Oscillation patterns were also recorded in a 5TsB crystal in the case of two opposing normally incident coherent light beams of equal intensity (230 W/sq cm) but polarized in different directions, with their electric field vectors at right or nearly right angles. Author

**N88-14731#** Joint Publications Research Service, Arlington, Va.
**PHOTOINDUCED LOW-TEMPERATURE CHANGES IN OPTICAL LOSSES IN FIBER OPTICS BASED ON CHALCOGENIDE GLASSES Abstract Only** **c74**
V. G. Borisevich, G. G. Devyatykh, Ye. M. Dianov, S. V. Ignatyev, V. G. Plotnichenko, I. V. Skripachev, M. F. Churbanov, V. A. Shipunov, and V. S. Shiryayev *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 5 Transl. into ENGLISH from Pisma v Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 13, no. 1, 12 Jan. 1987 p 35-38 Original language document was announced in IAA as A87-34408 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

An experimental study of fiber optics based on chalcogenide glasses and of changes in optical losses upon their cooling from 300 K to 77 K has revealed that the increase of optical losses is a result of photoinduced effects. Specimens of Ge5As38Se57, As30S70, As40S60 fibers 400 to 500 microns in diameters with 10 to 20 micron thick Teflon F-42 coating were tested in two different modes. Cooling without external illumination resulted in a narrowing and shifting of the absorption bands without an increase of optical losses above the original 0.2 to 2 dB/m. Lateral illumination during cooling was found to slowly decrease the transmission coefficient to a stable lower level, a level which dropped and was reached sooner with increasing illumination intensity. This effect is explained by action of photons with energy larger than the gap width producing metastable defect centers with energy levels within the gap. Illumination by a CI 10 to 300 U lamp with an intensity of 700 1x caused changes smaller than the measurement error at room temperature but of the order of 10,000 times larger at 77 K. Author

**N88-14732#** Joint Publications Research Service, Arlington, Va.
**POPULATION INVERSION IN GAPLESS SEMICONDUCTORS AS RESULT OF INTERBAND PUMPING Abstract Only** **c76**
G. M. Genkin, A. V. Okomelkov, and I. D. Tokman *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 6 Transl. into ENGLISH from Pisma v Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 13, no. 1, 12 Jan. 1987 p 32-35 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

Optical interband pumping of gapless semiconductor materials and the resulting nonequilibrium charge carrier distribution are analyzed, considering that excess photocarriers are produced by such pumping and after energy relaxation dip to the bottom of the respective band. Pumping sufficiently strong to produce a degenerate nonequilibrium carrier distribution can, therefore, also cause a population inversion at a band-to-band (conduction band-valence band) transition. Emission of optical phonons at temperatures far below that corresponding to the phonon frequency is the principal mechanism of photoelectron energy relaxation, photohole energy relaxation being much slower on account of the much larger mass. Computer simulation of the pumping kinetics on the basis of the corresponding transient-state equation, including recombination as well as electron-electron scattering, has yielded the dependence of amplification and internal absorption on the frequency of interband transitions for Cd(x)Hg(1-x)Te materials pumped by a CO2 laser with an intensity of 10,000 to 100,000 W/sq cm. Author

**N88-14733#** Joint Publications Research Service, Arlington, Va.
**ROTATION OF MAGNETIZED PARTICLE IN ELECTRICALLY CONDUCTING VISCOUS MEDIUM Abstract Only** **c34**
B. M. Berkovskiy, B. E. Kashevskiy, and Yu. V. Poroshin *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 9 Transl. into ENGLISH from Magnitnaya Gidrodinamika (Riga, USSR), no. 4, Oct. - Dec. 1986 p 37-42 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

The problem is considered of rotation at a constant speed of a uniformly magnetized spherical solid particle of an electrically conducting material such as iron immersed in an electrically conducting viscous medium and suspended in it by external forces. The magnetic moment of this particle is assumed to be frozen in it at any 0 less than theta less than or equal to 90 deg angle to the angular velocity vector, which removes the constraint of axial symmetry and thus generalizes the problem. The object is to determine the conduction currents induced in the medium around the particle, their interaction with the magnetic moment of the particle, and their effect on the Stokes moment of viscous forces acting on the particle. The medium is assumed to be an incompressible fluid and its flow is described in the Stokes approximation with negligible inertia forces, with a very low magnetic Reynolds number and plain Reynolds number but not so low a Hartmann number. The solution to the corresponding field equations for a rotating magnetic dipole in such a configuration is sought in series of associated Legendre polynomials representing spherical harmonics. On this basis are calculated the electric potentials of the medium and the particle, the body force acting on the medium, and the additional Stokes moment acting on the particle, as well as the velocity profiles in the medium at various orientations of the particle. Author

**N88-14734#** Joint Publications Research Service, Arlington, Va.
**NEW EQUILIBRIUM FORMS OF FREE SURFACE OF CONFINED MAGNETIC FLUID Abstract Only** **c34**
V. M. Berkovskiy, V. G. Bashtovoy, and A. G. Reks *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 10 Transl. into ENGLISH from Magnitnaya Gidrodinamika (Riga, USSR), no. 4, Oct. - Dec. 1986 p 11-16 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

An experimental study of two magnetic fluids, with a bubble of fluid resting on a horizontal plate in a uniform vertical magnetic field, has revealed new equilibrium forms of the free surface. The two fluids were MK-50 and MK-32. In the first experiment, a bubble with a volume of 450 cu mm was poured slowly on an iron plate in a magnetic field of threshold intensity, whereupon the magnetic field intensity was raised in 80 A/m steps. The shape of the bubble evolved and stabilized at each level of magnetic field intensity within a range between a lower critical and an upper critical, this range narrowing with increasing bubble volume. The bubble lost its topological stability and split as the magnetic field intensity was increased above the upper critical or decreased below the lower critical. In the second experiment, a bubble in the form of a cylindrical column reduced to a film was held by two parallel horizontal glass or Plexiglas plates and made hydrostatically weightless by immersion in an aqueous CaCl2 solution of the same density. Here the bubble retained its shape in a vertical magnetic field of intensity up to critical, remaining stable under mechanical loads but not so stable under asymmetric perturbations, with the critical magnetization increasing linearly with increasing column height but decreasing with increasing diameter. Author

**N88-14735#** Joint Publications Research Service, Arlington, Va.
**METHOD OF TWO-TIME GREEN FUNCTIONS IN MOLECULAR HYDRODYNAMICS OF SUPERFLUID LIQUID Abstract Only** **c34**
Yu. A. Tserkovnikov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 11 Transl. into ENGLISH from Teoreticheskaya i Matematicheskaya Fizika (Moscow, USSR), v. 69, no. 3, Dec. 1986 p 439-465 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

Correlation functions and Green functions are constructed for density and temperature fluctuations of a superfluid Bose liquid at temperatures below the critical point over the entire momentum and frequency ranges. A chain of equations relating the irreducible parts of Green functions to one another is used, with the appropriate operator basis, for derivation of equations in those Green functions, considering that the latter become related to one-particle Green functions through correlation functions for products of an odd number of operators once the gauge symmetry is broken. The resulting system of seven linear equations is solved with an extraction of singularities corresponding to fast evolution, the latter being determined by the frequency of interparticle collisions. With static susceptances as initial data, random fluctuating susceptances are calculated in terms of kinetic coefficients on the basis of the same equation chain or any other variant of perturbation theory. Comparison with results based on the equations of two-fluid hydrodynamics indicates that phenomenological macroscopic scale parameters can be expressed through microscopic scale quantities and thus be determined from quantum equations of motion for a system of interacting Bose particles. Author

**N88-14736#** Joint Publications Research Service, Arlington, Va.
**FAR FIELD OF STEADY WAVES PRODUCED BY LOCAL PERTURBATION SOURCES IN STREAM OF STRATIFIED FLUID Abstract Only** **c34**
V. F. Sannikov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 11 Transl. into ENGLISH from Prikladnaya Matematika i Mekhanika (Moscow, USSR), v. 50, no. 6, Nov. - Dec. 1986 p 987-995 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

Formation of waves during horizontal flow of a nonviscous incompressible vertically stratified fluid past point sources of perturbation is treated as a three-dimensional problem, only the steady state being considered. The differential equation for the vertical velocity component with a Brent-frequency term added and with a delta-function term on the right-hand side is formulated in the linear approximation, with appropriate boundary conditions at a source and at infinity as well as the condition of radiation. After a Fourier transformation in the space domain, this equation is solved as a Sturm-Liouville eigenvalue problem by uniform asymptotic expansions in the vicinity of mode fronts in the far field: expansions of Airy functions for a fluid body of finite depth. Author

**N88-14737#** Joint Publications Research Service, Arlington, Va.
**METHOD OF CALCULATIONS FOR FLOW OF IDEAL GAS THROUGH PLANE AND AXISYMMETRIC NOZZLES WITH BROKEN-LINE CONTOUR Abstract Only** **c34**
A. N. Krayko, N. I. Tillyayeva, and S. A. Shcherbakov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 12 Transl. into ENGLISH from Zhurnal Vychislitelnoy Matematiki i Matematicheskoy Fiziki (Moscow, USSR), v. 26, no. 11, Nov. 1986 p 1679-1694 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

A method of calculations for flow of an ideal gas through nozzles is outlined which combines the Godunov-Kolgan modification of the Godunov scheme with the method of characteristics, using analytical solutions at the nozzle axis and at an acoustic saliency. Monotonicity of the original Godunov scheme is retained, owing to a procedure for determining large quantities on both sides of the grid boundary. This combination method is applicable to any arbitrary two-dimensional or three-dimensional grid. Its efficiency and precision are demonstrated on irregular grids for nozzles with broken-line contours. As a test case, a nozzle contour is selected with a supersonic saliency, but resorting to the method of characteristics facilitates calculations for transonic and subsonic flow as well without restrictions on the degree of contour smoothness. Analytical solutions yield the inclination angle of the velocity vector on an acoustic line as a function of one coordinate so that the other coordinate can be found and the acoustic line can be plotted in the plane of flow. The method has been programmed on a BESM-6 high-speed computer. Author

**N88-14738#** Joint Publications Research Service, Arlington, Va.
**EFFECT OF OPTICAL INHOMOGENEITIES ON SPACE COHERENCE OF RADIATION EMITTED BY LASER WITH UNSTABLE RESONATOR Abstract Only** **c36**
L. A. Danilova, D. I. Staselko, and V. L. Strigun *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 13 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 61, no. 6, Dec. 1986 p 1287-1294 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

An experimental study of a laser with unstable resonator was made for the purpose of establishing the quantitative relation between space coherence of emitted radiation and optical distorting inhomogeneities in that resonator. The experiment was performed with a ruby laser in a plane-convex unstable resonator operating in the free emission mode. The resonator was L = 38 cm long and had an M = 2.8 magnification, formed by an opaque convex spherical mirror with an R = 1.35 m radius and a stack of plane-parallel glass plates. Typical inhomogeneities in a ruby crystal were subsequently simulated. Measurements with a Mach-Zander interferometer have yielded data necessary for analyzing the effect of inhomogeneities and evaluating it relative to the performance of a perfect laser crystal. Results indicate that the degree of space coherence depends on both size and shape of inhomogeneities, being influenced more by dynamic ones than by static ones. Author

**N88-14739#** Joint Publications Research Service, Arlington, Va.
**PRODUCTION-PROCESS CO2 LASER WITH AMPLIFIED PULSE-REPETITION OPERATION Abstract Only** **c36**
A. M. Belenkiy, V. V. Vasiltsov, V. S. Golubev, A. M. Zabelin, F. V. Lebedev, P. G. Leonov, D. K. Medvedev, A. A. Morozenkov, S. K. Chekin, and R. G. Shakirov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 14 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 8, Aug. 1986 p 1720-1722 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

An experimental device was set up consisting of a master ILGN-702 laser which produced radiation which could be modulated for pulse length and frequency by a chopper with an adjustable disc which is in the optical tract connecting to a TL-10S production-process laser. Square pulses at frequencies set by the chopper are obtained at the output of the amplifier. In continuous operation with amplifier power of 50 kW and master oscillator power of 270 W the output was 6.5 kW due to saturation. In pulse-repetition operation with a pulse frequency of 0 to 4 kHz, the amplifier produced pulse peaks of 36 kW. This is due to the accumulation of population inversion between the pulses; also, increasing the pulse frequency reduces pulse power. Many production processes require both continuous and pulse-repetition operation and this can be attained by adjusting the radiation chopper. The master oscillator-amplifier design is perferable to pulse-repetition lasers because there is less beam divergence and it is possible to adjust pulse frequency and peak power, utilize both repetition and continuous operation and achieve better beam polarization. A defect is the possibility of back reflection in the complex optical tract to the master oscillator. Author

**N88-14740#** Joint Publications Research Service, Arlington, Va.
**SUPER-SHORT YTTRIUM ALUMINATE PULSE GENERATOR WITH CONTROLLED RESONATOR Q-FACTOR Abstract Only** **c36**
A. M. Valshin, V. M. Gordiyenko, S. V. Krayushkin, V. T. Platonenko, and V. K. Popov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 14-15 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 13, no. 8, Aug. 1986 p 1713-1716 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

Solid-state lasers with passive mode-locking are now used to produce picosecond pulses for spectroscopy, study of relaxation processes and radiation, and laser and optical technology. However, the energy and time characteristics are insufficient for effective synchronization with other pulse devices. An experimental study was made of a passive mode-locked yttrium aluminate (YALO3:Nd(3+)) laser with Q-factor resonator control. The Q-control forms a locked pulse which leads the picosecond pulse train and can be regulated within the limits of 300 to 1500 ns with a precision of + or - 5 ns. It is possible to reduce the lasing pulse from 35 to 15 ps, improve stability of second harmonic energy from + or - 50 to + or - 9 percent and length stability from + or - 25 to + or - 5 percent and raise pulse reproducibility to 99.6 percent, thus facilitating synchronization with other laser devices. The mechanism is described for the Q-factor control and involves a feedback circuit with two photodiodes connected to a shutter and to a pulse-forming block. The experimental results were obtained by means of an Elektronika D3-28 microcomputer. Author

**N88-14741#** Joint Publications Research Service, Arlington, Va.
**PERIODICALLY PULSED EXCIMER MASTER OSCILLATOR-REGENERATIVE AMPLIFIER LASER SET Abstract Only** **c36**
V. P. Ageyev, V. V. Atezhev, V. S. Bukreyev, S. K. Vartapetov, A. I. Zhukov, V. I. Konov, and A. D. Savelyev *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 15 Transl. into ENGLISH from Pisma v Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 13, no. 1, 12 Jan. 1987 p 19-22 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

A periodically pulsed excimer laser set consisting of a master oscillator and a regenerative amplifier is proposed for improvement of laser beam characteristics, particularly decreasing divergence in the case of short pumping pulses and attendant high gain. Each active medium is pumped by electric discharge, both discharge circuits using magnetic switches with a common commutator so that the laser energy characteristics and the time separation between gain buildup in the two lasers can be simultaneously optimized. An experimental set was built with a Model 170 excimer laser as amplifier and a compact excimer laser as oscillator. Tests were performed with F2 + Kr + He mixtures lasing at lambda = 248, with and without injection. Emission pulses were produced at a repetition rate of 20 Hz and the beam divergence was measured through a lens with a focal length of 300 cm. The oscillator beam with a divergence of 600 microrad carried an energy of 700 microJ per pulse and was amplified to 35 mJ. The divergence of the amplified beam in the direction parallel to that of the discharge current was 140 microrad without injection and 80 microrad with injection. Divergence in the perpendicular direction was 90 microrad without and with injection. Author

**N88-14742#** Joint Publications Research Service, Arlington, Va.
**OBSERVING EFFECT OF LASER RADIATION OF LOW-FREQUENCY RAMAN SCATTERING OF LIGHT Abstract Only** **c36**
K. V. Grechushkin and A. V. Pivovarov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 16 Transl. into ENGLISH from Pisma v Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 45, no. 1, 10 Jan. 1987 p 8-9 Original language document was announced in IAA as A87-39052 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

An experimental study was made for the purpose of observing the effect of laser radiation on low-frequency Raman scattering of light. Specimens of water bidistillate and aqueous glucose solution as well as specimens of polycrystalline amino acids (valine, leucine, isoleucine, threonine, histidine, phenylalanine) were irradiated by a He-Cd laser (lambda = 4416) with a power of 30 mW. Spectrograms covering the 30 to 300/cm range were recorded in less than 120 s with the aid of a DFS-12 diffractive double monochromator. Laser radiation was found to have changed the low-frequency scattering spectrum of all these substances so as to indicate a restructurization of the hydrogen bonds. Slowness of this process in both forward and reverse directions is evidently caused by structural relaxation. Author

**N88-14743#** Joint Publications Research Service, Arlington, Va.
**NONUNIFORMITY OF ELECTROMAGNETIC FIELD AT LAMBDA = 10.6 MICRON WAVELENGTH INSIDE ATMOSPHERIC AEROSOL PARTICLES Abstract Only** **c46**
N. N. Belov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 33 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 61, no. 6, Dec. 1986 p 1331-1336 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

Probing of the atmosphere with a CO2 laser (lambda = 10.6 microns) is considered, absorption of optical radiation and emission of heat by solid atmospheric aerosol particles being analyzed on the basis of the Mie theory. The nonuniform radial distributions of electromagnetic field intensity and heat emission intensity are determined in the approximation of geometrical optics, assuming spherical particles. Calculations are made separately for weakly absorbing and strongly absorbing substances (Al2O3, ice, SiO2, MgO, NaCl, soot, graphite, coal), different treatment being required in each case for particles with radii smaller than the radiation wavelength (0.02 to 0.1 micron), for particles with radii comparable with the radiation wavelength, and for particles with radii larger than the radiation wavelength (30 to 60 microns). As a simplification covering the entire range is proposed focusing the radiation at the center of a spherical particle, assuming smaller than critical incidence angles and selecting the Brewster angle as critical in the case of a real refractive index or the zero-refraction angle as critical in the case of a complex refractive index. Author

**N88-14744#** Joint Publications Research Service, Arlington, Va.
**NEW DESCRIPTION OF LAU EFFECT BASED ON THEORY OF RASTER IMAGE FORMING PROCESS Abstract Only** **c74**
M. V. Shovgenyuk *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 34 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 61, no. 6, Dec. 1986 p 1308-1311 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

Formation of a high-contrast interference pattern with color fringes following Fresnel diffraction of noncoherent light successively by two identical gratings parallel one behind the other is described on the basis of the theory of raster image formation. Such a description conforms to a general relation, never before derived, for the intensity distribution under conditions of the Lau experiment. This relation, derived here with the aid of Fourier analysis and assuming a point source of noncoherent light, deals also with the fine structure of interference fringes. The corresponding Lau conditions are sufficient only in the case of precisely monochromatic light. The relation can be extended to dichromatic and polychromatic light, however, considering that the difference between wavelengths decreases as the distance between the gratings is increased. Author

**N88-14745#** Joint Publications Research Service, Arlington, Va.
**SELECTION OF HOLOGRAPHIC SCREEN FOR PROJECTION OF IMAGES RECONSTRUCTED BY MULTIASPECT HOLOGRAMS OF FOCUSED IMAGES Abstract Only** c35
A. D. Galpern and A. A. Paramonov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 34 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 61, no. 6, Dec. 1986 p 1320-1325 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

Recording multiaspect holograms and their copying as multiaspect holograms of focused images is considered for recording and reproducing three-dimensional images of natural objects. Projection of such images on a holographic screen requires achromatization, since the dispersion of such multiaspect holograms causes multicolor tinting of the image when the latter is viewed by a vertically moving eye. A geometrically achromatized system has been found to produce a parasitic pattern of spots in the viewing window, evidently traceable to the holographic screen and associated with the speckle structure recorded on that screen. The feasibility of minimizing or altogether eliminating this parasitic pattern is examined by analysis of the field intensity distribution and the eye response taking into account their statistical characteristics, an image being viewed in noncoherent light. The results indicate that in the case of many brightness gradations and semitones it is preferable to select point focusing screens, to use a point source rather than a diffuse strip for recording, and to widen the viewing window by use of a long vertical strip source for reconstructing. Author

**N88-14746#** Joint Publications Research Service, Arlington, Va.
**PARAMETRIC AND RESONANCE INTERACTION OF ULTRASHORT LIGHT PULSES IN NONLINEAR MULTILEVEL MEDIUM Abstract Only** c74
A. A. Zabolotskiy *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 38 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 92, no. 1, Jan. 1987 p 46-55 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

Interactions of ultrashort light pulses in nonlinear multilevel media are analyzed on the basis of a new self-consistent system of nonlinear equations integrable by the method of the inverse scattering problem. This system of equations has been formulated in the Laz representation so as to include as special cases the Maxwell-Block equations describing self-induced transparence, parametric resonance conversion of ultrashort pulses, and the equations of multiwave interaction. It is first applied here to resonance interaction of a three-wave packet and a three-level medium including non-resonance three-wave interaction, in which case there exists a soliton solution. It is then applied to resonance interaction of a six-wave packet and a quadratically nonlinear four-level medium, with simultaneous six-wave interaction, multipole solutions corresponding here to decay of a pumping soliton into several solitons with different frequencies. The Backlunf transformation relating two solutions to the new system of equations and recurrence relations which yield an infinite series of momentum integrals are derived for the case of three-wave interaction at exact resonance. Author

**N88-14747#** Joint Publications Research Service, Arlington, Va.
**STATE PARAMETERS OF PULSE-DISCHARGE PLASMA IN XENON-FILLED CLOSED TUBE Abstract Only** c75
V. Ye. Gavrilov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 39 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 61, no. 6, Dec. 1986 p 1192-1196 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

In a diagnostic study of pulse-discharge plasma in xenon flash tubes, the state parameters of such a plasma were measured in an experiment by spectroscopic methods. The plasma temperature was determined from the spectral density, brightness, and absorptivity in accordance with the Kirchhoff-Planck law. The plasma density and pressure were determined in two independent ways, first on the basis of the temperature distribution and the Saha relation, assuming a uniform pressure distribution over the tube volume and a constant gas mass during measurement, then on the basis of the half-width of the spectral absorption line of hydrogen added in small amounts to xenon. The results have been used for evaluating the dependence of the plasma temperature and pressure on the density of the electric discharge current over the 0 to 10 kA/sq cm range under initial xenon pressures of 6.7 to 80 kPa as well as the dependence of the plasma density and pressure on the plasma temperature and of the plasma pressure on the electron concentration and on the discharge power. Author

**N88-14748#** Joint Publications Research Service, Arlington, Va.
**EFFECT OF PLASMA ROTATION IN TOKAMAK ON STABILIZING ACTION OF ELECTRICALLY CONDUCTING WALL Abstract Only** c75
L. Ye. Zakharov and S. V. Putvinskiy *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 40 Transl. into ENGLISH from Fizika Plazmy (Moscow, USSR), v. 13, no. 1, Jan. 1987 p 118-119 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

It is already known that, unlike an ideally conducting shield near the boundary of a tokamak plasma filament, a shield with finite electrical conductivity does not remove the conditions for helical instability of such a plasma but only reduces the instability increment. It is now demonstrated analytically that rotation of the plasma does not improve the stabilizing action of such a shield. The proof is based on the model of a cylindrical plasma with uniform current moving at a constant velocity in the axial direction through vacuum. The presence of a stationary mode causes the residual instability increment to be independent of the speed of plasma rotation and to depend only on the effective skin-effect time of the shield. Author

**N88-14749#** Joint Publications Research Service, Arlington, Va.
**EFFECT OF PLASMA RESONANCE ON PROPERTIES OF SURFACE WAVES Abstract Only** c75
M. I. Bakunov, V. D. Pikulin, and N. S. Stepanov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 41 Transl. into ENGLISH from Fizika Plazmy (Moscow, USSR), v. 13, no. 1, Jan. 1987 p 62-65 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

Plane traveling transverse magnetic (TM) mode waves harmonic in space and in time are considered on the surface of a plasma nonhomogeneous within a -d less than or = x less than or = d region with a cubic-law rise of the charge concentration in the vicinity of x = 0, of interest being the effect which resonance of such a plasma has on those waves. The problem is analyzed on the basis of the corresponding wave equation and three field equations, as well as the dispersion equation for the longitudinal wave number. It is demonstrated that plasma resonance occurring at a point where the concentration gradient is zero or almost zero can not only prevent propagation but also ensure existence of such surface waves with either normal or anomalous dispersion. Author

**N88-14750#** Joint Publications Research Service, Arlington, Va.
**CONFINEMENT OF ENERGY IN TOKAMAK-10 PLASMA DURING ELECTRON-CYCLOTRON-RESONANCE HEATING Abstract Only** c75
V. V. Alikayev, A. A. Bagdasarov, N. L. Vasin, Yu. V. Yesipchuk, A. Ya. Kislov, G. Ye. Notkin, and K. A. Razumova *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 41-42 Transl. into ENGLISH from Fizika Plazmy (Moscow, USSR), v. 13, no. 1, Jan. 1987 p 3-19 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

A series of experiments with boost heating of a tokamak plasma at electron cyclotron resonance (ECR) frequency was performed for a study of plasma energy confinement and its relaxation with increasing heating power. The data were found to closely fit the Mukhovatov-Merezhin or neoalkator scaling in the low-current range and the Kaye-Goldston scaling in the high-current range, while indicating that confinement during ECR-heating is not an analog of L-mode confinement. The data have further yielded global characteristics of plasma energy confinement during ECR-heating and their dependence on the radial profile of power absorption. They have also revealed differences between confinement during ECR-heating and during Joule-effect heating respectively. The results are compared with those of TFTR and ASDEX experiments. An important factor on which the feasible degree of confinement depends is the limiting profile, apparently determined by the stability of resistive helical and ballooning modes. Author

**N88-14751#** Joint Publications Research Service, Arlington, Va.
**LOW-FREQUENCY OSCILLATIONS IN NONIDEAL PLASMA Abstract Only** **c75**
M. A. Berkovskiy, A. A. Valuyev, and Yu. K. Kurilenkov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 42 Transl. into ENGLISH from Pisma v Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 13, no. 2, 26 Jan. 1987 p 90-94 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

The spectrum and the characteristics of low-frequency oscillations in a homogeneous and isotropic nonideal plasma are examined. Ion-acoustic oscillations in a nonisothermal plasma with T sub e much greater than T sub i are considered, their decay in an isothermal plasma being the result of energy dissipation in the space charge by nonresonant collisions rather than a resonant collisionless mechanism and also by principally electronic heat conduction. Plain acoustic oscillations can also occur at frequencies below the frequency of ion-ion collisions. The frequency of ion-electron collisions in a nonideal plasma is high and such collisions are significant under isothermal conditions with T sub e = T sub i. Collective oscillations in a nonideal plasma are characterized by a large amplitude even under equilibrium conditions. Author

**N88-14752#** Joint Publications Research Service, Arlington, Va.
**SELF-ALIGNMENT OF IONS DRIFTING IN PLASMA Abstract Only** **c75**
S. A. Kazantsev, A. G. Petrashen, N. T. Polezhayeva, V. N. Rebane, and T. K. Rebane *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 43 Transl. into ENGLISH from Pisma v Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 45, no. 1, 10 Jan. 1987 p 15-17 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

The hypothesis that drift of ions in a plasma causes their spontaneous alignment with a quadrupole orientation of their angular momentum was confirmed in an experiment with ionization of argon in a 100 to 400 V hollow-cathode discharge tube 5 cm long and 3 cm in diameter. Distinct difference signals corresponding to the fine structure were recorded within the narrow low-pressure range of 0.1 to 0.5 torr at discharge currents of 10 to 60 mA. A comparison of difference signals from atomic argon and from weakly ionized argon proves the drift hypothesis of self-alignment most directly. The experimental data confirm also other predictions, namely that self-alignment of ions is closely associated with collisional mixing of half-levels in the fine structure of ions and that the self-alignment signal originates from a deviation of the ratio (N sub 1)/(N sub 2) of respective half-level populations from the ratio (g sub 1)/(g sub 2) of their statistical weights. Author

**N88-14753#** Joint Publications Research Service, Arlington, Va.
**DEPENDENCE OF ACOUSTICAL CHARACTERISTICS OF LASER-INDUCED BREAKDOWN IN DIELECTRIC MATERIALS ON SHAPE OF INELASTIC REGION Abstract Only** **c36**
A. Yu. Ivanov and E. A. Manykin *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 46 Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedeniy: Fizika (Tomsk, USSR), v. 29, no. 11, Nov. 1986 p 105-108 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

Generation of acoustic waves in a transparent dielectric material following its breakdown by a laser beam is analyzed theoretically, taking into consideration the real ellipsoidal rather than ideal spherical shape of the inelastic region and its prolateness in the direction of the laser beam. The boundary conditions at the surface of this region are stipulated in terms of zero shear strains and pressure or normal stress decreasing exponentially with time over duration of the laser pulse, assuming that the surfaces of the specimen are so far from the inelastic region inside as to have a negligible effect on the process. The corresponding wave equations for the displacement vector are solved in Legendre series, after this vector has been resolved into a longitudinal component which is the gradient of a scalar potential and a transverse component which is the curl of a vector potential. In an ellipsoidal system of coordinates each term of the series is the product of two Legendre functions, with a coefficient, one of the first kind of a circular trigonometric argument and one of the second kind of a hyperbolic trigonometric argument. At far distance from the inelastic region the solution simplifies, inasmuch as shear waves do not reach the detector before longitudinal waves have already been recorded. Author

**N88-14754#** Joint Publications Research Service, Arlington, Va.
**DEVELOPMENT OF CRACK UNDER PERIODICALLY PULSED LASER RADIATION Abstract Only** **c36**
G. Ya. Glauberman, S. V. Kondrashov, N. F. Pilipetskiy, S. Yu. Savanin, and V. V. Shkunov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 48 Transl. into ENGLISH from Zhurnal Prikladnoy Mekhaniki i Tekhnicheskoy Fiziki (Novosibirsk, USSR), no. 6(160), Nov. - Dec. 1986 p 108-110 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

An experimental study of laser-induced crack development in polymer materials was made with a periodically pulsed low-power LTIPCh-8 laser irradiating oriented polymethyl methacrylate. The laser radiation was focused on specimens already containing microcracks in pulses of 1/600 W average power at a repetition rate of 50 Hz. The crack growth was tracked by means of high-speed photography. Data on the absorption wavelength and the crack diameter as functions of time indicate that they increase with time linearly and according to a half-power law respectively. These results fit a theoretical interpretation on the basis of laser energy-pulse characteristics and gas thermodynamics, assuming that crack growth is an isothermal process and that an ideal gas is generated in the crack space with no relaxation or change in the number of gas molecules during intervals between laser pulses. Mathematical analysis leads to a linear first-order differential equation of cracking kinetics whose solution confirms the experimental results. Experiments performed by Yu. V. Sidornyy indicate that a nearly ideal gas is generated in cracks during irradiation in periodic pulses. Author

**N88-14755#** Joint Publications Research Service, Arlington, Va.
**EXPERIMENTAL OBSERVATION OF PHOTORESONANCE OF ELECTRONS LOCALIZED ABOVE SURFACE OF SOLID HYDROGEN Abstract Only** **c72**
V. V. Zavyalov and I. I. Smolyaninov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 49-50 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheshoy Fizki (Moscow, USSR), v. 92, no. 1, Jan. 1987 p 339-349 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

Resonant absorption of light corresponding to 1 to 2 and 1 to 3 transitions of electrons localized above the surface of solid hydrogen was observed in an experiment with an H2 crystal and laser spectroscopy. The electric field intensity necessary for photoresonant 1 to 2 transition was found to increase, less than

linearly, with increasing pressure above the solid hydrogen surface. The frequencies of both transitions were found to increase linearly with increasing electric field intensity. The resonance line width of 1 to 2 transition was found to increase with increasing H2-vapor or D2-vapor pressure. These results are explained in terms of quantum refraction (multiple scattering). Extrapolation of the transition frequency to zero electric field intensity and its linear decrease with increasing concentration of H2 molecules in gaseous phase, with a correction for the temperature dependence of that concentration and thus of the dielectric permittivity of solid hydrogen, yield a 1 to 2 transition frequency of 3.15 + or - 0.05 THz and a potential barrier for electrons on a solid hydrogen surface of 3.5 + or - 0.3 eV. Author

**N88-14756#** Joint Publications Research Service, Arlington, Va.
**ANOMALIES IN ELECTROMAGNETIC ABSORPTION OF CIRCULARLY POLARIZED ULTRASONIC WAVES BY TUNGSTEN WITHIN DOPPLER-SHIFTED CYCLOTRON RESONANCE RANGE Abstract Only** **c71**
V. V. Gudkov and I. V. Zhevstovskikh *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 50 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 92, no. 1, Jan. 1987 p 208-220 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

Electromagnetic absorption of circularly polarized ultrasonic waves by tungsten is analyzed theoretically on the basis of new experimental evidence about anomalies in the dependence of the absorption coefficient on the magnetic field intensity within the cyclotron range, these anomalies being related to a Doppler shift, and on the basis of more precise data pertaining to the resonance field intensity within the Doppler-phonon resonance range. Interpretation of measurements of two cylindrical tungsten specimens, based on the Fermi-surface model and determination of the nonlocal-conductivity tensor with circular components, leads to the conclusion that Doppler-shifted cyclotron resonance of electrons with maximum momentum in tungsten occurs in the form of a quasi-wave Doppler-phonon resonance in (-) polarization and two quasi-three-dimensional (pseudo-Doppler-phonon) resonances in different circular polarizations. These resonances, manifesting a field interaction of the elastic subsystem and conduction electrons, appear as a main peak and two companion peaks on the absorption curves. Author

**N88-14757#** Joint Publications Research Service, Arlington, Va.
**STUDIES OF TUNNELING IN METALS UNDER HIGH PRESSURE Abstract Only** **c26**
V. M. Svistunov, M. A. Belogolovskiy, and O. I. Chernyak *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 51-52 Transl. into ENGLISH from Uspekhi Fizicheskikh Nauk (Moscow, USSR), v. 151, no. 1, Jan. 1987 p 31-66 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

Fundamental concepts about tunneling in metal-insulator-metal structures and the theory of tunnel junctions are reviewed, including the pressure dependence of their current-voltage characteristic and barrier properties, as are also known techniques of high-pressure and low-temperature experiments. Superconductivity is of particular interest, as is tunnel spectroscopy. Nontransition metals, Nb, Ta, and La, are treated separately. Calculation of the superconducting transition temperature for a given metal on the basis of exact relations with the aid of tunnel-experiment data on the electron-phonon interaction is explained, as is verification of those data on the basis of the tunnel density of states at energy levels above the phonon spectrum of a given metal. A great deal of interest is shown in binary systems with compositions near the phase equilibrium boundary, attainable by pressure and impurity control. Such systems are Pb-Bi, Bi-Tl, In-Sn. Electron spectroscopy has been found to be an effective method of measuring dimensional effects, namely the quantum dimensional effect and the A. F. Andreyev reflection of electrons in thin metal films. Author

**N88-14758#** Joint Publications Research Service, Arlington, Va.
**MODEL OF EARLIER STAGE OF UNIVERSE'S EVOLUTION Abstract Only** **c90**
K. A. Bronnikov and V. N. Melnikov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 53 Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedeniy: Fizika (Tomsk, USSR), v. 29, no. 11, Nov. 1986 p 54-58 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

A scenario of the evolution of the universe has been proposed on the basis of an open nonsingular model symmetric in time and consisting of four stages: (1) spontaneous breaking of the conformal symmetry in unified theories of the Weinberg-Salam type with gravitational background, assuming that only a conformal Higgs field and a gravitational field have nonzero averages in vacuum; (2) spontaneous breaking of the gauge symmetry of a Higgs field in a gravitational field; (3) generation of particles in a nonsteady gravitational field; (4) variation of the effective gravitational coupling. The model is initially cold and then becomes hot as particles are generated or phase transition occurs. The dynamics of this model and the corresponding earlier stage of evolution are determined by the time term in the Einstein equations, analysis and solution of which require that deviation of the scalar field from classical and a possible attendant effect on the polarization of vacuum be taken into account. The essential underlying feature of this model is the concept of evolution from a perfect vacuum and thus a cold state with subsequent expansion from a nonsingular state and expansion implied by the cosmological constant. Author

**N88-14759#** Joint Publications Research Service, Arlington, Va.
**EVOLUTION OF PERTURBATIONS IN EXPANDING UNIVERSE Abstract Only** **c90**
A. A. Kofman and V. F. Mukhanov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 54 Transl. into ENGLISH from Pisma v Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 44, no. 11, 10 Dec. 1986 p 481-483 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

The behavior of perturbations during evolution of the universe, particularly in its expanding stage, is analyzed on the basis of the gravitation theory with total action and inclusion of higher order derivatives. Using the metrics of the flat homogeneous and isotropic cosmological model with small scalar perturbations for the relativistic gauge potential, a system of two equations of perturbations differential with respect to conformal time is derived from the system of corresponding two Einstein equations. They are then reduced to a single second-order differential equation in a new variable. This equation is solved asymptotically. Considering that the large class of solution to the Einstein equations for the quiescent phonon model includes the asymptotic quasi-deSitter mode of evolution, the solution is extended to the subsequent scalar stage. Perturbations, conformally plane in the quasi-deSitter stage, are found to become conformally Newtonian upon transition to the scalar stage and to build up to the galactic scale while shifting from the short-wave mode to the long-wave mode. The amplification factor 3.6H squared/M squared is constrained by H 5 times 10 to the 13th and M 10 to the 13th GeV. Author

**N88-14760#** Joint Publications Research Service, Arlington, Va.
**GRAVITATIONAL INTERACTION OF MASSLESS FIELDS WITH HIGHER SPINS (s GREATER THAN 2) Abstract Only** **c90**
M. A. Vasilyev and Ye. S. Fradkin *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 54-55 Transl. into ENGLISH from Pisma v Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 44, no. 11, 10 Dec. 1986 p 484-488 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

Massless fields with higher spins (s greater than 2) and the problem of consistently including their gravitational interaction are considered, using a description of these fields in a two-dimensional and anti-deSitter space. With the aid of an N = 1 superalgebra

for higher spins, it is demonstrated that consistent gravitational interaction of such massless fields exists at least in the first nontrivial order. Using the explicit invariant action S in generalized coordinates for description of spin dynamics, the first variation delta S is shown to be zero by virtue of two earlier proposed relations and upon appropriate transformation with specially selected coefficients. This action together with those two relations is accordingly found to consistently describe the dynamics of all massless fields with spins greater than or = 3/2 in the cubic approximation, involving only two independent constants: the gravitational constant and the cosmological one. Author

**N88-14761#** Washington State Univ., Pullman. Dept. of Physics.
**RESEARCH ON ACOUSTICAL SCATTERING, DIFFRACTION CATASTROPHES, OPTICS OF BUBBLES, PHOTOACOUSTICS, AND ACOUSTICAL PHASE CONJUGATION Annual Summary Report No. 7, 1 Oct. 1986 - 15 Sep. 1987**
Philip L. Marston 15 Sep. 1987 86 p
(Contract N00014-85-C-0141)
(AD-A185785) Avail: NTIS HC A05/MF A01 CSCL 20A

The propagation and scattering of acoustical and optical waves are discussed. Topics included are: 1) Acoustical scattering theory and experiments for elastic objects in water (the coupling of sound with surface waves on fluid loaded elastic objects as described by a generalization of GTD, confirmation from measurements of focused backscattering due to Lamb waves on a spherical shell); 2) Light scattering from real bubbles and microbubbles in water (the unfolded glory or backscattering pattern of an oblate bubble in water, observation of Brewster angle scattering of polarized light and the effects of adsorbed films which may coat the bubble); 3) Production of sound by a drop or bubble in water illuminated by modulated laser light and the optical levitation of bubbles; 4) Acoustical and optical diffraction catastrophes (theory and optical simulation of transverse cusps, experiments with acoustical transverse cusps produced by reflection from smooth surfaces and the merging of echoes at caustics, the wavefield in a hyperbolic umbilic focal section, applications to the theory of shock wave focusing); 5) Acoustical phase conjugation (theory of the focal-point shift for the reversed wave resulting from three-wave mixing in a bubble layer, experimental evidence for the existence of such a wave). GRA

**N88-14872*#** Michigan Technological Univ., Houghton. Dept. of Mechanical Engineering/Engineering Mechanics.
**DYNAMICS FORMULATIONS FOR THE REAL-TIME SIMULATION OF CONSTRAINED MOTION Final Report**
Frederick A. Kelly *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 20 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 20C

# 71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environmental Pollution.*

**N88-14762*** United Technologies Corp., Stratford, Conn. Sikorsky Aircraft Div.
**DEVELOPMENT OF ROTORCRAFT INTERIOR NOISE CONTROL CONCEPTS. PHASE 3: DEVELOPMENT OF NOISE CONTROL CONCEPTS Final Report**
Charles A. Yoerkie, P. J. Gintoli, S. T. Ingraham, and J. A. Moore (Cambridge Collaborative, Inc., Mass.) Jul. 1986 148 p
(Contract NAS1-16932)
(NASA-CR-178172; NAS 1.26:178172) Avail: NTIS HC A07/MF A01 CSCL 20A

The goal of this research is the understanding of helicopter internal noise mechanisms and the development, design, and testing of noise control concepts which will produce significant reductions in the acoustic environment to which passengers are exposed. The Phase 3 effort involved the identification and evaluation of current and advanced treatment concepts, including isolation of structure-borne paths. In addition, a plan was devised for the full-scale evaluation of an isolation concept. Specific objectives were as follows: (1) identification and characterization of various noise control concepts; (2) implementation of noise control concepts within the S-76 SEA (statistical energy analysis) model; (3) definition and evaluation of a preliminary acoustic isolation design to reduce structure-borne transmission of acoustic frequency main gearbox gear clash vibrations into the airframe; (4) formulation of a plan for the full-scale validation of the isolation concept; and (5) prediction of the cabin noise environment with various noise control concepts installed. Author

**N88-14763*#** Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
**SOUND PROPAGATION OVER UNEVEN GROUND AND IRREGULAR TOPOGRAPHY Semiannual Status Report No. 6, Aug. 1987 - Jan. 1988**
Yves H. Berthelot, Allan D. Pierce, Geoffrey L. Main, Ji-xun Zhou, and James A. Kearns Jan. 1988 88 p
(Grant NAG1-566)
(NASA-CR-182352; NAS 1.26:182352) Avail: NTIS HC A05/MF A01 CSCL 20A

The goal of this research is to develop theoretical, computational, and experimental techniques for predicting the effects of irregular topography on long range sound propagation in the atmosphere. Irregular topography is understood to imply a ground surface that is not idealizable as being perfectly flat or that is no idealizable as having a constant specific acoustic impedance. The focus is on circumstances where the propagation is similar to what might be expected for noise from low-altitude air vehicles flying over suburban or rural terrain, such that rays from the source arrive at angles close to grazing incidence. Author

**N88-14764#** Massachusetts Inst. of Tech., Cambridge. Acoustics and Vibration Lab.
**THE ACOUSTIC SOURCE CREATED BY TURBULENT FLOW OVER ORIFICES AND LOUVERS**
Glenn Eric Cann and Patrick Leehey Jun. 1987 104 p
Sponsored by General Dynamics Corp., Groton, Conn.
(Rept-97674) Avail: NTIS HC A06/MF A01

Orifice and louver sound power spectra are investigated, using an intensity probe, at various wind speeds in a low noise, semi-anechoic, subsonic wind tunnel for free stream velocities below 50 m/s. The radiated noise is created by turbulent flow over various orifice and louver geometries which are flush mounted on the wall of a long duct. Five orifice samples of rectangular shape and various transverse dimensions as well as four louver samples with multiple rectangular and circular orifices are tested. Also investigated is the effect of the leading and trailing edge angle on the radiated sound power. The scaling laws of the excitation frequencies and the speed/power laws are presented for ratios of the boundary layer thickness to the transverse orifice dimension from 1.01 to 4.29. A detailed theoretical model is developed for rectangular shaped aperture orifices and louvers. The model describes the predominant variables which effect the radiated flow noise. To ascertain the validity of the model, it is used to collapse the experimental power spectra for two orifice and one louver geometry. The model showed excellent agreement with sound power measurements. Directivity plots are also presented to further describe the orifice/louver source. Author

**N88-14765** Stanford Univ., Calif.
**WAVES AND VIBRATIONS IN ELASTIC SUPERLATTICE COMPOSITES Ph.D. Thesis**
Yuzhong Wang 1987 211 p
Avail: Univ. Microfilms Order No. DA8720443

Piezoceramic-plastic composite materials have aroused interest because of their high electrical coupling, low acoustic impedance,

and reduced mechanical crosstalk in arrays. Elastic Bloch wave theory for these elastic superlattices was used to explain the mechanical properties of the composite. An infinite sum of vector space harmonics is the solution of acoustic wave propagation in the unbounded periodic composite. Detailed investigations were carried out for one-dimensional periodic elastic composites, including numerical evaluations of the Bloch matrix with varying degrees of truncation. A normal mode theory was developed for periodic composite plates. Other methods for solving waves propagating in elastic superlattice media, and comparisons between different methods, were also discussed. Measurements were performed on composite plate transducers to test the accuracy of the theory. The theoretical predictions were verified by performing electrical impedance measurements to determine the frequencies of the stopband resonances, and laser probe measurements were used to identify the elastic vibration patterns at these frequencies. Dissert. Abstr.

**N88-14766** Cornell Univ., New York, N.Y.
**A STUDY OF ROTOR BROADBAND NOISE MECHANISMS AND HELICOPTER TAIL ROTOR NOISE Ph.D. Thesis**
Shau-Tak Rudy Chou 1987 189 p
Avail: Univ. Microfilms Order No. DA8715625

A study is made of the relative problems of rotor broadband noise mechanisms and helicopter tail rotor noise. The rotor broadband noise mechanisms considered are: (1) lift fluctuation due to turbulence ingestion, (2) boundary layer/trailing edge interaction, (3) tip vortex formation, and (4) turbulent vortex shedding from blunt trailing edge. Predictions are compared to available experimental data and show good agreement. The study shows that inflow turbulence is the most important broadband noise source for typical helicopters' main rotors at low- and mid-frequencies. Trailing edge noise and tip vortex noise are found to be important at high frequencies; they are also very sensitive to rotor blade angle of attack. Trailing edge thickness noise is also very important; it generates a large spectrum hump, and is very sensitive to any change of the trailing edge thickness. Dissert. Abstr.

**N88-14767#** Rome Univ. (Italy). Dipartimento di Fisica.
**TRANSPORT COEFFICIENTS CLOSE TO THE MOBILITY EDGE AND NONLINEAR SIGMA MODEL COMPOSITE OPERATORS**
C. Castellani and G. Kotliar (Massachusetts Inst. of Tech., Cambridge.) 28 Jan. 1987 35 p
(Preprint-541; ETN-88-91255) Avail: NTIS HC A03/MF A01

The conductivity and the ultrasonic attenuation coefficient are expressed in terms of nonlinear sigma-model composite operators. The conductivity is represented by the sum of local and nonlocal terms. The nonlocal part is given by a correlation function of operators involving derivatives. It is expected to vanish to three loop order in the orthogonal case but gives a non-zero result at two loop order in the unitary case. The ultrasonic attenuation coefficient is represented by a local term only. This result is used to derive the scaling behavior of the ultrasonic attenuation coefficient close to the mobility edge in the orthogonal and unitary case. ESA

**N88-14768#** Rome Univ. (Italy). Dipartimento di Fisica.
**ACOUSTICAL PHASE CONJUGATION**
Daniele Fargion and Franco Valli 16 Jun. 1987 5 p
(Preprint-561; ETN-88-91274) Avail: NTIS HC A02/MF A01

A mathematical and physical system able to reproduce, mechanically, a time reversed wave front is proposed. A multimicrophone array system records the sound wave. Then it reverses, by coherent time reversal, the signal. This technique may have radical consequences in geology, sea studies, and archeological investigation. ESA

**N88-14769*#** Sikorsky Aircraft, Stratford, Conn.
**DEVELOPMENT OF ROTORCRAFT INTERIOR NOISE CONTROL CONCEPTS. PHASE 2: FULL SCALE TESTING, REVISION 1 Contractor Report, May 1983 - Dec. 1985**
C. A. Yoerkie, P. J. Gintoli, and J. A. Moore (Cambridge Collaborative, Inc., Mass.) Feb. 1986 284 p
(Contract NAS1-16932)
(NASA-CR-172594-Rev-1; NAS 1.26:172594-Rev-1; SER-760703)
Avail: NTIS HC A13/MF A01 CSCL 20A

The phase 2 effort consisted of a series of ground and flight test measurements to obtain data for validation of the Statistical Energy Analysis (SEA) model. Included in the gound tests were various transfer function measurements between vibratory and acoustic subsystems, vibration and acoustic decay rate measurements, and coherent source measurements. The bulk of these, the vibration transfer functions, were used for SEA model validation, while the others provided information for characterization of damping and reverberation time of the subsystems. The flight test program included measurements of cabin and cockpit sound pressure level, frame and panel vibration level, and vibration levels at the main transmission attachment locations. Comparisons between measured and predicted subsystem excitation levels from both ground and flight testing were evaluated. The ground test data show good correlation with predictions of vibration levels throughout the cabin overhead for all excitations. The flight test results also indicate excellent correlation of inflight sound pressure measurements to sound pressure levels predicted by the SEA model, where the average aircraft speech interference level is predicted within 0.2 dB. Author

**N88-14770#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
**MEASURING THE ANNOYANCE OF AIRCRAFT NOISE M.S. Thesis**
Russell K. Marcks 1986 96 p
(AD-A185494; AFIT/CI/NR-87-71T) Avail: NTIS HC A05/MF A01 CSCL 20A

This report addresses the jet engine noise levels in the proximity of airports. Noise measurements are given and the relation of noise levels to atmospheric conditions is related. This information is compiled to aid engineers in the construction of buildings near airports for maximum sound attenuation. GRA

**N88-14728#** Joint Publications Research Service, Arlington, Va.
**NONLINEAR REFLECTION OF SOUND WAVE IN GAS MIXTURE Abstract Only**
A. M. Dykhne and S. V. Pokrovskiy *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 1 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 92, no. 1, Jan. 1987 p 87-96 Original language document was announced in IAA as A87-34369 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14756#** Joint Publications Research Service, Arlington, Va.
**ANOMALIES IN ELECTROMAGNETIC ABSORPTION OF CIRCULARLY POLARIZED ULTRASONIC WAVES BY TUNGSTEN WITHIN DOPPLER-SHIFTED CYCLOTRON RESONANCE RANGE Abstract Only**
V. V. Gudkov and I. V. Zhevstovskikh *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 50 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 92, no. 1, Jan. 1987 p 208-220 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

# 72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

**N88-14771#** Louisiana State Univ., Baton Rouge.
**RESEARCH IN ELEMENTARY PARTICLE PHYSICS Progress Report, 1 Mar. 1987 - 28 Feb. 1988**
Lai-Him Chan, Richard Haymaker, Richard Imlay, and William Metcalf 1987 129 p

(Contract DE-AS05-77ER-05490)
(DE88-002130; DOE/ER-05490/84) Avail: NTIS HC A07/MF A01

We describe theoretical work on effective action expansion on an effective low energy theory of hadrons, dynamical symmetry breaking, and lattice gauge theories. The high energy experimental group at Louisiana State University is taking data on a neutrino oscillation experiment at LAMPF. Analysis is in progress. LSU is also participating on an electron-positron experiment, AMY, that is running at TRISTAN in Japan. LSU is responsible for the muon detector for AMY. We are analyzing a 5 pb sup -1 data obtained in the summer of 1987. Preliminary results have been presented at conferences and one paper has been submitted for publication. DOE

**N88-14772#** Rome Univ. (Italy). Dipartimento di Fisica.
**ON THE SPIN STRUCTURE OF THE ELASTIC PPBAR SCATTERING AMPLITUDE**
R. Bizzarri, A. E. Kudryautsev, and V. E. Markushin 16 Jul. 1987 19 p
(Nota-Interna-892; ETN-88-91253) Avail: NTIS HC A03/MF A01

The theoretical uncertainties for the total cross section and for the ratio of the real to imaginary part of the scattering amplitude at zero angle are discussed. The uncertainties are connected with the spin structure of the p p bar amplitude. For example, the theoretical uncertainty for the total cross section is 20mb at plab = 181 Mev/c. Different possible solutions for the scattering amplitude, which are in agreement with the existing experimental results are considered. These solutions show a rather large p-wave (3P2 or 3P1) rapidly varying on a smooth background from the other P-waves and the S-waves. ESA

**N88-14773#** Rome Univ. (Italy). Dipartimento di Fisica.
**SCALAR DENSITIES AND BARYON MASS DIFFERENCES IN LATTICE QCD WITH WILSON FERMIONS**
L. Maiani, G. Martinelli, M. L. Paciello, and B. Taglienti (Istituto Nazionale di Fisica Nucleare, Rome, Italy ) 23 Feb. 1987 48 p Sponsored in part by Italian Ministry of Public Education
(Preprint-544; ETN-88-91257) Avail: NTIS HC A03/MF A01

The normalization constant and the proton matrix elements of the scalar quark densities on a 10 cu x 20 lattice, at Beta = 6.0, in the quenched approximation and for 3 values of the Wilson parameter: K = 0.1515, 0.1530, 0.1545 were derived. The normalization constant agrees with a derived Ward identity. In terms of the usual D and F of the baryon octet mass differences, D/F = -0.4 + or -0.2, in agreement with the experimental value (D/F)exp = -0.3. It is seen that D/F decreases in absolute value for large quark mass, as suggested by the constituent quark model. Using a previous lattice determination of quark masses, M -Mp = 210 + or -60 MeV, to be compared with the measured value (M -Mp)exp = 380 MeV. The nucleon sigma term is 15 + or -4 MeV. ESA

**N88-14774#** Rome Univ. (Italy). Dipartimento di Fisica.
**VECTOR BOSON PAIR PRODUCTION IN e(+)e(-) COLLISIONS**
B. Mele (Istituto Nazionale di Fisica Nucleare, Rome, Italy ) 24 Mar. 1987 12 p Presented at La Thuile Workshop on Physics at Future Accelerators, Aosta Valley, Italy, 7-13 Jan. 1987 Submitted for publication
(Preprint-549; ETN-88-91262) Avail: NTIS HC A03/MF A01

Pair production of W(+) W(-) and W (+/-) Z (0) through gamma gamma and gamma W fusion in e(+) e(-) collisions is discussed as a background to heavy Higgs boson production. Total cross sections and angular distributions are evaluated in the real gamma and W approximation at energies sq root S = 2 TeV. Cuts in the transverse momentum of the final vector boson pair are expected to be very effective in reducing the gamma gamma yields WW background, but this type of cut does not greatly affect the gamma W yields ZW signal, which receives a substantial transverse momentum from the initial W. ESA

**N88-14775#** Rome Univ. (Italy). Dipartimento di Fisica.
**SINGLE WEAK GAUGE BOSON PRODUCTION AT CLIC**
E. Gabrielli 24 Mar. 1987 14 p Presented at La Thuile Workshop on Physics at Future Accelerators, Aosta Valley, Italy, 7-13 Jan. 1987 Submitted for publication
(Preprint-550; ETN-88-91263) Avail: NTIS HC A03/MF A01

Production of single W (+/-) and Z (0) in e(+) e(-) collisions at sq root S = 0 (1 TeV), is studied in the real photon approximation. Total cross sections as well as transverse momentum and rapidity distributions are derived. The sensitivity to nonstandard values of the W (+/-) anomalous magnetic moment is analyzed. The production of new heavy vector bosons is considered. ESA

**N88-14776#** Rome Univ. (Italy). Dipartimento di Fisica.
**THE STANDARD THEORY GROUP: SUMMARY AND CONCLUSIONS**
Guido Altarelli 24 Mar. 1987 45 p Presented at La Thuile Workshop on Physics at Future Accelerators, Aosta Valley, Italy, 7-13 Jan. 1987
(Preprint-551; ETN-88-91264) Avail: NTIS HC A03/MF A01

Discovery physics at LHC and CLIC colliders within the scope of the electronweak model is discussed. The search for the Higgs boson and related subjects (charged Higgs, weak interactions becoming strong, etc.) are considered. The search for new quarks and leptons and the production of intermediate vector bosons are reviewed. ESA

**N88-14777#** Rome Univ. (Italy). Dipartimento di Fisica.
**A THEORETICAL MODEL FOR NEUTRINO MASSES AND MIXING**
M. Lusignoli 16 Apr. 1987 6 p Presented at the 6th Moriond Workshop on Search of New and Exotic Phenomena, Les Arcs, France, 25-31 Jan. 1987
(Preprint-553; ETN-88-91266) Avail: NTIS HC A02/MF A01

Neutrino masses and mixings and the possible milligravitational fifth force are related in a theoretical frame extending the gauge group of the standard model with a U(1) factor whose gauge boson mediates the fifth force. The experimental implications are discussed. In the model, the majoron is eaten up by the gauge boson and becomes its longitudinal degree of freedom. The assumed relation with the fifth force implies fixing at the Fermi scale of UQ(1) symmetry breaking; moreover, the gauge boson is also coupled to baryon number and therefore is able to produce other effects, on top of making heavy neutrinos unstable. ESA

**N88-14778#** Rome Univ. (Italy). Dipartimento di Fisica.
**A POSSIBLE ACCELERATOR EXPERIMENT TO SOLVE THE SOLAR NEUTRINO PUZZLE**
A. Capone, M. DeVincenzi, U. Dore, O. Palamara, V. Palladino, P. Pistilli, H. Wachsmuth, and D. Zanello 23 Apr. 1987 17 p Submitted for publication
(Preprint-556; ETN-88-91269) Avail: NTIS HC A03/MF A01

The possibility to use an intense neutrino beam from an accelerator combined with an underground detector to study nu-oscillation is shown. Configurations in which the sensitivity to oscillation parameters is comparable with solar neutrino experiments are discussed. The pi's and K's produced by the interaction of the 30 GeV protons are focused by a magnetic horn and are allowed to decay over a 200 m long tunnel. At 1 km from the target is placed a detector, similar to ICARUS but with a much smaller mass (10 ton). This close detector identifies neutrino interactions and measures the energy distribution and nu-e content of the beam. It is compared with the far detector ICARUS placed at a distance L. The combination of the intense neutrino flux with the large fiducial mass (5000 tons) of ICARUS can collect in a few months 1000 interactions at a distance of 1000 km. The (nu-e)-(nu-mu) oscillation appears as an increase of the nu-e/nu-mu ratio in the far with respect to the close detector. ESA

**N88-14779#** Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
**WRONG HELICITY EVENTS INDUCED BY THE CERN-SPS WIDE BAND MUONIC (ANTI)NEUTRINO BEAM**
N. vanEijnhoven 22 Jan. 1987 9 p
(NIKHEF-H/87-2; B8709438; ETN-88-91334) Avail: NTIS HC A02/MF A01

By means of a study of like and unlike sign muonic events, seen in an (anti)neutrino-deuterium experiment, the wrong helicity beam backgrounds for the CERN-SPS wide band neutrino and antineutrino beams are determined. The contamination of fake muon events in the charged current event sample, due to the decay of charged hadrons in flight and incorrect muon identification by the external muon identifier and internal picket fence systems, is estimated. ESA

**N88-14780#** Amsterdam Univ. (Netherlands). Wiskunde en Natuurwetenschappen.
**DETERMINATION OF THE NEUTRAL CURRENT CHIRAL COUPLING CONSTANTS U SUBLSQ, U SUBRSQ, D SUBLSQ AND D SUBRSQ FROM AN (ANTI)NEUTRINO-DEUTERIUM EXPERIMENT Ph.D. Thesis**
Nicolaas Johannes Ad vanEijndhoven 1987 125 p Sponsored by the Nationaal Instituut voor Kernfysica en Hoge-Energiefysica, Amsterdam, Netherlands
(B8715857; ETN-88-91358) Avail: NTIS HC A06/MF A01

Neutrino and antineutrino interactions on deuterium in a bubble chamber are presented. Deuterium was chosen as target material because it provides a means to study interactions on protons and neutrons separately within the same experimental setup. The neutral (NC) and charged current (CC) ratios are given. Using the observed NC/CC ratios, the individual chiral coupling constants are determined with high accuracy due to the fact that they are all determined within one experiment. By fitting the data, values for the basic parameters of the standard model are obtained. The results agree very well with the predictions of the standard model. ESA

**N88-14781#** Naval Research Lab., Washington, D.C.
**X-RAY STRUCTURE ANALYSES AND MOLECULAR MECHANICS ANALYSES OF DENSE ENERGETIC MATERIALS Annual Report, Oct. 1985 - Oct. 1986**
Richard Gilardi, Clifford George, and Judith L. Flippen-Anderson 1 Jul. 1987 107 p
(AD-A185462) Avail: NTIS HC A06/MF A01 CSCL 07C

Structural characterization of 22 energetic materials and precursors was performed with X-ray diffraction. GRA

**N88-14755#** Joint Publications Research Service, Arlington, Va.
**EXPERIMENTAL OBSERVATION OF PHOTORESONANCE OF ELECTRONS LOCALIZED ABOVE SURFACE OF SOLID HYDROGEN Abstract Only**
V. V. Zavyalov and I. I. Smolyaninov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 49-50 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 92, no. 1, Jan. 1987 p 339-349 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

# 73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

**N88-14782#** Nuclear Utility Services, Inc., Rockville, Md.
**A LONG TERM RADIOLOGICAL RISK MODEL FOR PLUTONIUM-FUELED AND FISSION REACTOR SPACE NUCLEAR SYSTEM**
B. W. Bartram and D. K. Dougherty 1987 124 p
(Contract DE-AC01-80ET-32079)
(DE87-010466; DOE/ET-32079/2; NUS-3845) Avail: NTIS HC A06

This report describes the optimization of the RISK III mathematical model, which provides risk assessment for the use of a plutonium-fueled, fission reactor in space systems. The report discusses possible scenarios leading to radiation releases on the ground; distinctions are made for an intact reactor and a dispersed reactor. Also included are projected dose equivalents for various accident situations. DOE

**N88-14783#** Science Research Council, Chilton (England).
**COLLIDER CONSTRAINTS IN THE CHOICES FOR WAVELENGTH AND GRADIENT SCALING**
J. D. Lawson Jun. 1986 9 p
(PB87-123691; RAL-86-069) Avail: NTIS HC E03/MF E03 CSCL 20H

During the last few years many suggestions have been made for novel accelerating schemes, with the aim of making center-of-mass energies of 1 TeV and above available for e(+) and e(-) collisions at a socially acceptable cost. A wavelength range from micrometers to centimeters, and field gradients from tens to thousands of MeV per meter have been considered. It is now evident that the need for high luminosity with acceptable power cost in the face of destructive collider constraints imposes severe restrictions on the choices available. An attempt is made to examine these in a general way, but with emphasis on wavelength and gradient scaling. Nonharmonic schemes, where an equivalent wavelength must be assigned, are included in the survey, and the use of multiple bunches considered. The need for essentially new inventive suggestions is emphasized. GRA

**N88-14784#** Air Force Weapons Lab., Kirtland AFB, N. Mex.
**SHIELDING ANALYSIS OF A SMALL COMPACT SPACE NUCLEAR REACTOR Final Report**
Lee L. Woodrow, Jr. Aug. 1987 214 p
(AD-A185566; AFWL-TR-87-94) Avail: NTIS HC A10/MF A01 CSCL 18F

The SP-100 reactor, currently in its developmental stage, has a layered tungsten-lithium hydride shield. Studies indicate that this shield configuration is the lightest weight shield. This configuration and three other shielding concepts were analyzed to determine the lightest shield and to determine the shield configuration with the smallest volume. The other concepts were a boron carbide-beryllium layered shield, and a lithium hydride-beryllium shield. FEMP2D and FEMP1D codes were used in this analysis. These codes were developed at Sandia National Laboatory (SNL), using the input from another code, RFCC, which produced enery dependent dose conversion factors, and determined the shields' ability to attenuate the neutron and gamma radiation to permissible dose limits. The results of this analysis show that the lithium hydribe-tungsten layered shield was indeed the lightest weight shield. Volume, not weight, may be the driving factor in determining the shield configuration. GRA

**N88-14785#** National Bureau of Standards, Gaithersburg, Md. Center for Radiation Research.
**NBS (NATIONAL BUREAU OF STANDARDS) MEASUREMENT SERVICES: SPECTRAL REFLECTANCE Final Report**
V. R. Weidner and J. J. Hsia Jul. 1987 146 p
(PB88-109905; NBS/SP-250/8; LC-87-619843) Avail: NTIS HC A07/MF A01; also available SOD HC $7.00 as 003-003-02812-6 CSCL 20H

The report describes the instrumentation, standards, and techniques used in the measurement of spectral reflectance over the ultraviolet, visible, and near infrared spectral ranges. The report is divided into three parts. Part 1 describes the guiding philosophy for maintaining reference and transfer spectrophotometers for spectral reflectance measurements, and standards and services that are available. Part 2 describes the NBS high accuracy reference spectrophotometer including specially developed accessory reflectometers. The instrument provides the basis for the development of absolute NBS standards of diffuse and specular

reflectance. Part 3 describes the NBS transfer spectrophotometer, a high precision commercial spectrophotometer used for calibrating Standard Reference Materials (SRM) such as diffuse reflectance and specular reflectance standards. GRA

# 74 OPTICS

Includes light phenomena; and optical devices.
For lasers see *36 Lasers and Masers.*

**N88-14786#** Texas Univ., Austin. Center for Particle Theory.
**COHERENCE, PROPAGATION AND FLUCTUATIONS OF LIGHT: A GENERALIZED RAY APPROACH**
R. Simon, N. Mukunda, and E. C. G. Sudarshan Oct. 1987 70 p Presented at the Symposium on the Coherence, Propagation and Fluctuations of Light: The Optical Field, Rochester, N.Y., 24 Oct. 1987 Prepared in cooperation with Institute of Mathematical Sciences, Madras, India and Indian Inst. of Science, Bangalore
(Contract DE-FG05-85ER-40200)
(DE88-001669; DOE/ER-40200/119; CONF-8710182-1) Avail: NTIS HC A04/MF A01

Radiative transfer theory, wave optics and paraxial optics including Fourier optics can be treated uniformly and without any approximation in terms of generalized pencils of rays. This development is reviewed and the role of the groups SL(2,R), Sp(4,R) for paraxial propagation elaborated. The problem of polarization is studied with special care and correctly treated where explicit use of the Poincare group is made. Higher order correlations are taken up within the generalized pencil formalism, the differences between quantum and classical wave optics are highlighted. The effects of Bose quantization on ray-ray correlations is calculated and displayed. DOE

**N88-14787*#** Alabama Univ., Huntsville. Dept. of Chemistry.
**PARTIAL ANALYSIS OF EXPERIMENT LDEF A-0114 Annual Report, for period ending 31 May 1986**
J. C. Gregory 31 May 1986 6 p
(Contract NAS8-36645)
(NASA-CR-179236; NAS 1.26:179236) Avail: NTIS HC A02/MF A01 CSCL 20F

Due to delays in manifesting the return of the Long Duration Exposure Facility from space, attention was concentrated on extracting the maximum information from the EIOM-2 (oxygen interaction with materials experiment) flown on STS-8 in September 1983. An analysis was made of the optical surfaces exposed during that flight and an assessment made of the effect of the 5 eV atomic oxygen upon their physical and chemical properties. The surfaces studied were of two types: high-purity thin films sputtered or evaporated onto 2.54-cm diam lambda/20 fused silica optical flats, and highly polished bulk samples. Rapid etching of carbon and carbonaceous surfaces was observed with polycarbonate CR-39 showing the largest etch of any substrate flown and measured. Of the metals tested, only osmium and silver showed large effects, the former being heavily etched and the later forming a very thick layer of oxide. The first measurable effects on iridium, aluminum, nickel, tungsten and niobium thin films are reported. M.G.

**N88-14788#** Science Research Council, Daresbury (England).
**USE OF SPHERICAL OPTICS IN HIGH RESOLUTION SOFT X-RAY GRATING MONOCHROMATORS**
H. A. Padmore Jul. 1986 21 p Presented at the Workshop on X-Ray Optics, Problems in Materials, Manufacture and Performance, Upton, N.Y., 4-6 Jun. 1986
(PB87-125191; DL/SCI/P-518E) Avail: NTIS HC E03/MF E03 CSCL 20F

The resolution of the present generation of soft X-ray monochromators is severely limited by excessive tangential slope errors in aspheric optical elements. As very high quality spherical surfaces can be made, several designs are presented which use only spherical optics. The simplest of these is an entrance slitless negative order monochromator employing a spherical grating in a TGM mounting. Astigmatism is corrected by use of a cylindrical premirror. GRA

**N88-14789#** Research Inst. of National Defence, Linkoeping (Sweden).
**FIBER OPTIC VIDEO LINK**
Bjoern Wendel Jan. 1987 86 p Partly in SWEDISH and ENGLISH
(FOA-C-30444-3.1; ISSN-0347-3708; ETN-88-90744) Avail: NTIS HC A05/MF A01; Research Institute of National Defence, Stockholm, Sweden KR 50

A link which uses pulse frequency modulation is described, together with measurement results, which show that the length of the fiber could be raised to 600 m instead of 90 m, at an optical damping of 6 dB per km, with an acceptable effect at the receiver. Frequencies 10 Hz to 5.5 MHz are allowed, i.e., the total frequency spectrum of the video signals. Modulation methods for transmission of analog information in optical fibers are described. ESA

**N88-14790#** Research Inst. of National Defence, Linkoeping (Sweden).
**FIBER OPTIC SINGLE MODE SENSORS**
Jan-Peter Bengtsson Mar. 1987 45 p In SWEDISH; ENGLISH summary
(FOA-C-30453-3.1; ISSN-0347-3708; ETN-88-90745) Avail: NTIS HC A03/MF A01; Research Institute of National Defence, Stockholm, Sweden KR 50

Interferometers based on double beam multiple beam differential, and reciprocal methods are reveiwed. Mach-Zehnder and Michelson interferometers are analyzed. The homodyne method, the heterodyne technique, and pseudoheterodyne signal processing are described. An interference occurs if a coherent support is used, as a laser. Diode lasers are frequently utilized, but as noise reduction is important gas lasers are recommended. ESA

**N88-14791#** Technische Univ., Brunswick (West Germany). Fakultaet fuer Maschinenbau und Elektrotechnik.
**DESIGN, PRODUCTION, AND CHARACTERIZATION OF BROADBAND OPTiCAL WAVEGUIDES Ph.D. Thesis [EINE DIREKTE BERECHNUNGSMETHODE FUER STOERFELDER BEWEGTER KOERPER IN KOMPRESSIBLEN MEDIEN BEI UNTERSCHALL-MACHZAHLEN]**
Hans-Heinrich Kohlmeier 1985 97 p In GERMAN
(DFVLR-FB-85-52; ETN-88-90809) Avail: NTIS HC A05/MF A01

Multimode-gradient and monomode fibers were designed, produced, and characterized for wavelength-multiplex applications. The dispersion characteristics of multimode fibers designed with special exponential index-of-refraction profiles were determined. The fibers were produced using the method of Modified Chemical Vapor Deposition (MCVP), leading to composed exponential profiles. The dependence of the index-of-refraction increase on the dopant flux was determined. Damping, index-of-refraction profile, bandwidth, and pulse broadening of the multimode fibers were measured. The dispersion characteristics of monomode fibers with single and multiple jackets were determined. The fibers were produced using the MCVP method. The damping and the index-of-refraction profile of the monomode fibers were determined. ESA

**N88-14792#** Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Electrical Engineering.
**A SURFACE PLASMON WAVEGUIDE SENSOR: A NEW TYPE OF CHEMICAL TRANSDUCER BASED ON OPTICAL PHENOMENA**
H. J. M. Kreuwel, Th. J. A. Popma, P. V. Lambeck, and G. J. Gerritsma 1986 5 p Presented at the 2nd International Meeting on Chemical Sensors, Bordeaux, France, 7-10 Jul. 1986
(ETN-88-91322) Avail: NTIS HC A02/MF A01

A planar waveguide sensor based on mode coupling between a common waveguide mode and a surface plasmon mode is introduced. The phase velocity of the plasmon mode, and thereby

the photon energy at which mode coupling occurs, is influenced by changes in the optical properties of a very thin organic coating. This coating can absorb the species to be measured. The sensor acts as a wavelength selective absorption filter. The sensor offers sharper resonances than prism attenuated total reflection configurations because the photons in the waveguide undergo multiple reflection. ESA

**N88-14793#** Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). System Control and Simulation Dept.
**STATISTICAL INVESTIGATIONS OF THE BEHAVIOR OF A PRODUCT CORRELATOR AND AN EDGE DETECTOR IN CRITICAL SITUATIONS**
Hermann Siebert and Wolfgang Engelhardt 16 Jan. 1987 23 p (MBB-UA-1034/87; ETN-88-91380) Copyright Avail: NTIS HC A03/MF A01

The lower performance limits of a product correlator and an edge detector relative to the camera noise, quantization of the image signal, object size, and contrast between object and background were determined using statistical methods. The lower limits for both tracking procedures are essentially the same. Assuming a camera with a characteristic noise parameter = 7, these limits consist of a contrast factor of 3, an object size of 4x4 pixels, and a quantization of 6 bits. While increasing object size and quantization results in only negligible increases in the tracking performance, it is possible to obtain optimal tracking performance in approximately all cases by increasing the contrast appropriately. Tracking accuracy above the specified limits is better than 0.5 pixel. For good contrast it is 0.1 pixel, the results for the correlator being better. However, the edge detector operates more reliably than the correlator for object sizes less than 4x4 pixels. ESA

**N88-14794#** Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
**SELF CALIBRATION OF MOTION AND STEREO VISION FOR MOBILE ROBOT NAVIGATION**
Rodney A. Brooks, Anita M. Flynn, and Thomas Marill Aug. 1987 27 p
(Contracts N00014-86-K-0685; N00014-85-K-0124)
(AD-A185602; AI-M-984) Avail: NTIS HC A03/MF A01 CSCL 20F

We report on experiments with a mobile robot using one vision process (forward motion vision) to calibrate another (stereo vision) without resorting to any external units of measurement. Both are calibrated to a velocity dependent coordinate system which is natural to the task of obstacle avoidance. The foundations of these algorithms, in a world of perfect measurement, are quite elementary. The contribution of this work is to make them noise tolerant while remaining simple computationally. Both the algorithms and the calibration procedure are easy to implement and have shallow computational depth, making them (1) run at reasonable speed on moderate uni-processors, (2) appear practical to run continuously, maintaining an up-to-the-second calibration on a mobile robot, and (3) appear to be good candidates for massively parallel implementations. GRA

**N88-14795#** National Bureau of Standards, Gaithersburg, Md. Center for Radiation Research.
**NBS (NATIONAL BUREAU OF STANDARDS) MEASUREMENT SERVICES: FRICKE DOSIMETRY IN HIGH-ENERGY ELECTRON BEAMS Final Report**
C. G. Soares, E. L. Bright, and M. Ehrlich Jul. 1987 58 p
(PB88-110374; NBS/SP-250/4; LC-87-619834) Avail: NTIS HC A04/MF A01; also available SOD HC $2.75 as 003-003-02816-9 CSCL 20F

The NBS Fricke-Dosimetry Service is described in detail. After a brief historical introduction and description of the service, the theoretical basis (including what quantities are measured, how, and why) and the philosophy of internal quality checks are discussed in some detail. This is followed by a description of the physical setup and of the step-by-step operating and reporting procedures. Throughout the section, there is reference to sample records of past performance, in order to facilitate continuity of operation in the case of personnel changes. The document concludes with a discussion of the uncertainties involved in the measurement quality assurance service, safety considerations, and an appendix containing samples of all form letters and of the final report mailed to participants. GRA

**N88-14220#** Joint Publications Research Service, Arlington, Va.
**DEVELOPMENTS IN OPTICAL SENSOR TECHNOLOGIES DESCRIBED**
Tatehiko Hidaka *In its* JPRS Report: Science and Technology, Japan 23 Sep. 1987 p 50-62 Transl. into ENGLISH from Optronics (Tokyo, Japan), Dec. 1986 p 74-80 (For primary document see N88-14213 06-31)
Avail: NTIS HC A05/MF A01

**N88-14222#** Joint Publications Research Service, Arlington, Va.
**STATUS, OUTLOOK OF OPTICAL TECHNOLOGY IN INFORMATION EQUIPMENT FIELD**
*In its* JPRS Report: Science and Technology. Japan 23 Sep. 1987 p 74-87 Transl. into ENGLISH from Optronics (Tokyo, Japan), Mar. 1987 p 65-73 (For primary document see N88-14213 06-31)
Avail: NTIS HC A05/MF A01

**N88-14328*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**AVIRIS FOREOPTICS, FIBER OPTICS AND ON-BOARD CALIBRATOR**
Michael P. Chrisp, Thomas G. Chrien, and L. Steimle *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results 15 Nov. 1987 p 25-30 (For primary document see N88-14325 06-35)
Avail: NTIS HC A06/MF A01 CSCL 14B

**N88-14560*#** Academy of Sciences (USSR), Ashkhabad. Inst. of Physical Technology.
**HARD- AND SOFTWARE PROBLEMS OF SPACED METEOR OBSERVATIONS BY OPTICAL ELECTRONICS**
R. I. Shafiev, S. Mukhamednazarov, and A. Sh. Ataev *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 416-420 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 20F

**N88-14730#** Joint Publications Research Service, Arlington, Va.
**OBSERVATION OF INSTABILITIES IN TIME DURING DYNAMIC SELF-DIFFRACTION OF LIGHT IN ANISOTROPIC NON-HOMOGENEOUS MEDIUM Abstract Only**
R. B. Alaverdyan, S. M. Arakelyan, A. S. Karayan, and Yu. S. Chilingaryan *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 4 Transl. into ENGLISH from Pisma v Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 13, no. 2, 26 Jan. 1987 p 119-123 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14731#** Joint Publications Research Service, Arlington, Va.
**PHOTOINDUCED LOW-TEMPERATURE CHANGES IN OPTICAL LOSSES IN FIBER OPTICS BASED ON CHALCOGENIDE GLASSES Abstract Only**
V. G. Borisevich, G. G. Devyatykh, Ye. M. Dianov, S. V. Ignatyev, V. G. Plotnichenko, I. V. Skripachev, M. F. Churbanov, V. A. Shipunov, and V. S. Shiryayev *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 5 Transl. into ENGLISH from Pisma v Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 13, no. 1, 12 Jan. 1987 p 35-38 Original language document was announced in IAA as A87-34408 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14744#** Joint Publications Research Service, Arlington, Va.
**NEW DESCRIPTION OF LAU EFFECT BASED ON THEORY OF RASTER IMAGE FORMING PROCESS Abstract Only**
M. V. Shovgenyuk *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 34 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 61, no. 6, Dec. 1986 p 1308-1311 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14746#** Joint Publications Research Service, Arlington, Va.
**PARAMETRIC AND RESONANCE INTERACTION OF ULTRASHORT LIGHT PULSES IN NONLINEAR MULTILEVEL MEDIUM Abstract Only**
A. A. Zabolotskiy *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 38 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 92, no. 1, Jan. 1987 p 46-55 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14886*#** Prairie View Agricultural and Mechanical Coll., Tex. Dept. of Electrical Engineering.
**TIME-DOMAIN ROBOTIC VISION APPLICATION Final Report**
C. L. Tolliver *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 22 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 22 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 20F

# 75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

**N88-14796#** Ames Lab., Iowa.
**ATLAS OF ATOMIC SPECTRAL LINES OF NEPTUNIUM EMITTED BY AN INDUCTIVELY COUPLED PLASMA**
E. L. DeKalb and M. C. Edelson Aug. 1987 140 p
(Contract W-7405-eng-82)
(DE88-000640; IS-4933) Avail: NTIS HC A07/MF A01

Optical emission spectra from high-purity Np-237 were generated with a glovebox-enclosed inductively coupled plasma (ICP) source. Spectra covering the 230 to 700 nm wavelength range are presented along with general commentary on the methodology used in collecting the data. DOE

**N88-14797#** Oak Ridge National Lab., Tenn.
**ATF (ADVANCED TOROIDAL FACILITY) ECH (ELECTRON CYCLOTRON HEATING) WAVEGUIDE COMPONENT DEVELOPMENT AND TESTING**
T. S. Bigelow, T. L. White, and H. D. Kimrey 1987 2 p Presented at the 12th Annual International Conference of the Institute of Electrical and Electronics Engineers on Infrared and Millimeter Waves, Orlando, Fla., 14 Dec. 1987
(Contract DE-AC05-84OR-21400)
(DE88-001432; CONF-871210-2) Avail: NTIS HC A02

The Advanced Toroidal Facility (ATF) Electron Cyclotron Heating (ECH) system presently under construction will consist of two 53.2-GHz, 200-kW continuous-wave (CW) gyrotrons with a mode-controlled waveguide system and polarized launcher optimized for maximum power in the ATF plasma. Several components, such as a waveguide mode-analyzing directional coupler, a TiO2 mode absorber, miter bends, and a polarization-selectable beamed launcher, have been developed and tested. Laboratory results and initial high-power operation of the system are presented. DOE

**N88-14798#** Los Alamos National Lab., N. Mex.
**THE TITAN OSCILLATING-FIELD CURRENT-DRIVE SYSTEM**
C. G. Bathke Oct. 1987 5 p Presented at the Symposium on Fusion Engineering, Monterey, Calif., 12 Oct. 1987
(Contract W-7405-eng-36)
(DE88-001823; LA-UR-87-3466; CONF-871007-41) Avail: NTIS HC A02

The TITAN study uses oscillating-field current drive (OFCD) for steady-state operation in a reversed-field-pinch (RFP) fusion reactor. A circuit model which simulates the plasma, first wall, blanket, and coils has been developed and applied to two TITAN reactor designs to assess OFCD efficiency and power-supply requirements. Methods for optimizing current-drive efficiency and minimizing power-supply requirements have been identified. DOE

**N88-14799#** Los Alamos National Lab., N. Mex.
**EDGE PLASMAS AND PLASMA/WALL INTERACTIONS IN AN IGNITION-CLASS REVERSED FIELD PINCH**
K. A. Werley, C. G. Bathke, and R. A. Krakowski 1987 6 p Presented at the Symposium on Fusion Engineering, Monterey, Calif., 12 Oct. 1987
(Contract W-7405-eng-36)
(DE88-001825; LA-UR-87-3464; CONF-871007-39) Avail: NTIS HC A02

A range of limiter, armor, and divertor options are examined as a means to minimize plasma/wall interactions for a high-power-density, ignition-class reversed field pinch. An open, toroidal-field divertor can operate at maximum powers, while isolating the core plasma from impurities and protecting the wall. DOE

**N88-14800#** Los Alamos National Lab., N. Mex.
**THE TITAN MAGNET CONFIGURATION**
C. G. Bathke 1987 11 p Presented at the Symposium on Fusion Engineering, Monterey, Calif., 12 Oct. 1987
(Contract W-7405-eng-36)
(DE88-001826; LA-UR-87-3462; CONF-871007-38) Avail: NTIS HC A03/MF A01

The TITAN study uses copper-alloy ohmic-heating coils (OHC) to start up inductively a reversed-field-pinch (RFP) fusion reactor. The plasma equilibrium is maintained with a pair of superconducting equilibrium-field coils (EFCs). A second pair of copper EFCs provides the necessary trimming of the equilibrium field during plasma transients. A compact toroidal-field-coil (TFC) set is provided by an integrated blanket/coil (IBC). The IBC concept also is applied to the toroidal-field divertor coils. Steady-state operation is achieved with oscillating-field current drive, which oscillates at low amplitude and frequency the OHCs, EFCs, the TFCs, and divertor coils about their steady-state currents. An integrated magnet design, which uses low-field, low technology coils, and the related design basis is given. DOE

**N88-14801#** Sandia National Labs., Albuquerque, N. Mex.
**BEHAVIOR AND STRUCTURE OF METAL VAPOR ARC PLASMA BETWEEN MOLTEN ELECTRODES**
F. J. Zanner, R. L. Williamson, W. A. Hareland, and L. A. Bertram 1987 10 p Presented at the 34th National Vacuum Symposium and Topical Conference, Anaheim, Calif., 2 Nov. 1987
(Contract DE-AC04-76DP-00789)
(DE88-001854; SAND-87-1798C; CONF-871125-8) Avail: NTIS HC A02/MF A01

A metal vapor arc is utilized in the industrially important vacuum arc remelting (VAR) process to produce materials by melting and resolidification which have improved structure and chemical homogeneity. Homogeneity is dependent on achieving quasi-steady conditions in the plasma because of its thermal and MHD coupling with the molten pool atop the ingot. Optimal operating conditions of low pressure (approx. = 0.01 torr) and short electrode gap (less than 15 mm) produce a diffuse arc and cathode spot behavior similar to that observed for the vacuum breaker arc. Under these conditions the arc provides a quasi-steady heat source that is considered to be the bench mark arc of the VAR process. Previous work has shown that deviation from the bench mark arc behavior can occur under production conditions, and is caused by electrode irregularities and liberation of gases such as CO from the molten

pool. This study is an effort to characterize these behavioral deviations and discover operational conditions which stabilize the bench mark arc. DOE

**N88-14802#** Lawrence Livermore National Lab., Calif.
**PLASMA PARAMETERS FOR ALTERNATE OPERATING MODES OF TIBER-2**
M. E. Fenstermacher, R. S. Devoto, B. G. Logan, and L. J. Perkins 16 Oct. 1987 6 p Presented at the Symposium on Fusion Engineering, Monterey, Calif., 12 Oct. 1987
(Contract W-7405-eng-48)
(DE88-001890; UCRL-96721; CONF-871007-45) Avail: NTIS HC A02/MF A01

Parameters for operating points of TIBER-2, different from the baseline steady-state operation, are presented. These results have been generated with the MUMAK tokamak power balance code. Pulsed ignited and high performance steady-state operating points are described. DOE

**N88-14803#** Lawrence Livermore National Lab., Calif.
**TIBER 2 (TOKAMAK IGNITION/BURN EXPERIMENTAL REACTOR) PARAMETERS WITH NEUTRAL BEAMS AT HIGH ENERGIES**
R. S. Devoto, M. E. Fenstermacher, and P. G. Papanikolaou 16 Oct. 1987 6 p Presented at the Symposium on Fusion Engineering, Monterey, Calif., 12 Oct. 1987 Prepared in cooperation with Purdue Univ., Lafayette, Ind.
(Contract W-7405-eng-48)
(DE88-001891; UCRL-97585; CONF-871007-44) Avail: NTIS HC A02/MF A01

The baseline neutral beam energy for TIBER 2 was chosen to be 500 keV consistent with the use of near term dc acceleration technology. Adequate penetration to the axis for core current drive in larger ETR devices requires higher beam energies. However, beam instabilities may limit the current drive efficiency at high energy to lower values than predicted classically. The characteristics of TIBER 2 and a device with 4.5 m major radius as functions of beam energy are presented. DOE

**N88-14804#** Lawrence Livermore National Lab., Calif.
**OVERVIEW OF THE TIBER 2 (THERMAL IGNITION/BURN EXPERIMENTAL REACTOR) DESIGN**
C. D. Henning and B. G. Logan 16 Oct. 1987 7 p Presented at the Symposium on Fusion Engineering, Monterey, Calif., 12 Oct. 1987
(Contract W-7405-eng-48)
(DE88-001892; UCRL-96873; CONF-871007-21) Avail: NTIS HC A02/MF A01

The TIBER 2 Tokamak Ignition/Burn Experimental Reactor design is the result of efforts by numerous people and institutions, including many fusion laboratories, universities, and industries. While subsystems will be covered extensively in other reports, this overview will attempt to place the work in perspective. Major features of the design are compact size, low cost, and steady-state operation. These are achieved through plasma shaping and innovative features such as radiation tolerant magnets and optimized shielding. While TIBER 2 can operate in a pulsed mode, steady-state is preferred for nuclear testing. Current drive is achieved by a combination of lower hybrid and neutral beams. In addition, 10 MW of ECR is added for disruption control and current drive profiling. The TIBER 2 design has been the US option in preparation for the International Thermonuclear Experimental Reactor (ITER). Other equivalent national designs are the NET in Europe, the FER in Japan and the OTR in the USSR. These designs will help set the basis for the new international design effort. DOE

**N88-14805#** Lawrence Livermore National Lab., Calif.
**MODELING OF THERMAL EFFECTS ON TIBER 2 (THERMAL IGNITION/BURN EXPERIMENTAL REACTOR) DIVERTOR DURING PLASMA DISRUPTIONS**
M. L. Bruhn and L. J. Perkins 16 Oct. 1987 6 p Presented at the Symposium on Fusion Engineering, Monterey, Calif., 12 Oct. 1987
(Contract W-7405-eng-48)
(DE88-001893; UCRL-96814; CONF-871007-22) Avail: NTIS HC A02/MF A01

Mapping the disruption power flow from the mid-plane of the TIBER Engineering Test Reactor to its divertor and calculating the resulting thermal effects are accomplished through the modification and coupling of three presently existing computer codes. The resulting computer code TADDPAK (Thermal Analysis Divertor during Disruption PAcKage) provides three-dimensional graphic presentations of time and positional dependent thermal effects on a poloidal cross section of the double-null-divertor configured reactor. These thermal effects include incident heat flux, surface temperature, vaporization rate, total vaporization, and melting depth. The dependence of these thermal effects on material choice, disruption pulse shape, and the characteristic thickness of the plasma scrape-off layer is determined through parametric analysis with TADDPAK. This computer code is designed to be a convenient, rapid, and user-friendly modeling tool which can be easily adapted to most tokamak double-null-divertor reactor designs. DOE

**N88-14806#** Science Applications International Corp., Boulder, Colo. Plasma Research Inst.
**SLOWING DOWN TAIL ENHANCED, NEOCLASSICAL AND CLASSICAL ALPHA PARTICLE FLUXES IN TOKAMAK REACTORS**
P. J. Catto and M. Tessarotto Oct. 1987 25 p Prepared in cooperation with Trieste Univ., Italy
(Contract DE-AC03-76ET-53057)
(DE88-001930; SAIC-87/1826; PRI-116) Avail: NTIS HC A03/MF A01

The classical and neoclassical particle and energy fluxes associated with a slowing down tail, alpha particle distribution function are evaluated for arbitrary aspect ratio, cross section, and poloidal magnetic field. The retention of both electron and ion drag and pitch angle scattering by the background ions dramatically increases the radial losses. The enhanced neoclassical losses will preclude ignition unless tokamak reactors are designed with a substantially smaller alpha banana width than previously believed necessary. DOE

**N88-14807#** Brookhaven National Lab., Upton, N. Y.
**TRISTAN RESEARCH ON NEUTRON RICH NUCLEI: MAGNETIC MOMENTS AND NUCLEAR STRUCTURE**
A. Wolf, R. F. Casten, R. L. Gill, D. S. Brenner, H. Mach, J. C. Hill, F. K. Wohn, and J. A. Winger 1987 10 p Presented at the 5th International Conference on Nuclei Far From Stability, Lake Rosseau, Canada, 14 Sep. 1987 Prepared in cooperation with Clark Univ., Worcester, Mass. and Ames Lab., Iowa
(Contracts DE-AC02-76CH-00016; W-7405-eng-32; DE-AC02-79ER-10493)
(DE88-002122; BNL-40316; CONF-870970-7) Avail: NTIS HC A02/MF A01

The TRISTAN research program is briefly outlined. The discussion then turns to the measurements of magnetic moments of excited states in neutron-rich fission product nuclei using the perturbed angular correlation method. The results for 2(+) sub 1 states are analyzed in light of the systematics of magnetic moments in the A = 70-200 region, and relation to collective nuclear models. DOE

**N88-14808#** Kiruna Geophysical Inst. (Sweden).
**COMMENTS ON THE THEORY OF ABSOLUTE AND CONVECTIVE INSTABILITIES**
T. Oscarsson and K. Roennmark Oct. 1986 9 p Submitted for publication
(PB87-124624; KGI/PREPRINT-094) Avail: NTIS HC E03/MF E01 CSCL 20I

The theory of absolute and convective instabilities in a plasma is discussed. The theory is questionable as it describes the linear development of instabilities by their behavior in the time asymptotic limit. In order to make sensible predictions on the linear

development of instabilities, the problem should be studied on the finite time scale implied by the linear approximation. Author

**N88-14809#** Technische Hogeschool, Eindhoven (Netherlands).
**INVESTIGATIONS ON AN RF PLASMA RELATED TO PLASMA ETCHING Ph.D. Thesis**
Theodorus Hubertus J Bisschops 1987 124 p Sponsored in part by the Netherlands Technology Foundation
(ETN-88-91366) Avail: NTIS HC A06/MF A01

An RF excited 13.56 MHz CF4 plasma, as used to etch integrated circuits, was investigated. A microwave cavity method which allows an accurate determination of the electron density in an RF-discharge was developed. It is found that the electron density varies linearly with the RF-power level for both a CF4 and an argon plasma. A distinct maximun in the electron density is found for a CF4 plasma as a function of the gas pressure if the plasma is ac-coupled. A less pronounced maximum is found for a dc-coupled plasma. For an argon plasma no maximum in the electron density is found as a function of the gas pressure. Optical emission measurements indicate a less than linear increase of fluorine density with increasing RF power, and an almost linear increase with gas power. ESA

**N88-14810#** Technische Hogeschool, Eindhoven (Netherlands). Electrical Energy Systems Div.
**GASDYNAMIC EFFECTS IN LINEAR MHD GENERATORS Ph.D. Thesis**
Johannes Cornelis Ni Bosma 1987 109 p Sponsored by the Netherlands Technology Foundation
(ETN-88-91372) Avail: NTIS HC A06/MF A01

The influence of nonuniform discharge structures, called streamers, on the flow field in a linear MHD generator is described. The so-called spark tracing method is used to determine locally the gas velocity. The experiments show that in a linear MHD generator with Faraday-type loading streamers move with a velocity up to 15% higher than the gas velocity. The density distribution shows that the argon atom density at the position of the streamer center is 40% lower than in the region in which the electrical current is zero. The shape of the mass density distribution is more or less cylindrically symmetric, with a characteristic radius of 10 to 20mm. To describe the flow in an MHD generator in the presence of a streamer, which is moving with a constant velocity, a time-dependent, two-dimensional model of this flow is presented. A special case of this flow problem is solved to show that the experimentally observed situation, in which the streamer is moving faster than the surrounding gas, can exist in an MHD generator. ESA

**N88-14811#** Kiruna Geophysical Inst. (Sweden).
**EVOLUTION OF SPECTRAL DENSITIES IN WEAKLY INHOMOGENEOUS PLASMAS**
K. Roennmark Oct. 1986 23 p Submitted for publication
(PB87-137402; KGI/PREPRINT-095) Avail: NTIS HC E03/MF E01 CSCL 20I

Theoretical studies of waves and instabilities are often performed for an infinite, homogeneous plasma, and the results are given in terms of eigenmodes (plane waves) extending over all space. Real plasmas are, however, always finite and inhomogeneous, and observations of waves in space are normally presented as frequency power spectra which depend on the time and place of observation. The purpose of the study is to reconcile these apparently disparate descriptions of plasma waves. A model describing inhomogeneous spectral densities in a homogeneous plasma is first discussed in some detail. A method, which allows the observable frequency power spectrum to be calculated from a space and time dependent dispersion relation and appropriate boundary conditions, is also outlined. GRA

**N88-14812#** United Technologies Corp., East Hartford, Conn.
**THEORETICAL STUDIES OF KINETIC MECHANISMS OF NEGATIVE ION FORMATION IN PLASMAS Annual Report, 1 Jun. 1986 - 31 May 1987**
H. H. Michels Jun. 1987 42 p
(Contract F49620-85-C-0095)
(AD-A185735; UTRC/R87-927258; AFOSR-87-1263TR) Avail: NTIS HC A03/MF A01 CSCL 20I

This technical program constitutes a theoretical research investigation of the kinetic mechanisms of negative ion information in plasmas. This study was directed toward elucidating the mechanisms of the most important volume-dependent reactions that occur in hydrogen-ion H(-)(D(-)) source devices, primarily of the Belchenko-Dimov-Dudnikov (BDD) type and toward evaluating other light negative anions, such as Li(-), as possible sources. The primary goal of this research program was to identify the most important reactions leading to negative ion production or destruction and to estimate these reactions rates as a function of system parameters such as density, composition and temperature. A further goal was to explore new chemical sources for the production of light mass negative atomic ions. The results of this program furnish data and provide direction for more detailed investigations into the kinetics of both gas phase and gas-surface reaction rates of importance in ion source devices and provide input for reliable modeling of such systems. This investigation was carried out using quantum mechanical methods. Both ab initio and density functional approaches were employed in these studies. GRA

**N88-14531*#** Kazan State Univ. (USSR).
**METHODS AND FIRST RESULTS OF PLASMA NON-ISOTHERMAL PARAMETERS MEASUREMENTS IN METEOR TRAILS**
K. K. Kostylev and V. S. Tokhtasjev *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 211-217 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 20I

**N88-14747#** Joint Publications Research Service, Arlington, Va.
**STATE PARAMETERS OF PULSE-DISCHARGE PLASMA IN XENON-FILLED CLOSED TUBE Abstract Only**
V. Ye. Gavrilov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 39 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 61, no. 6, Dec. 1986 p 1192-1196 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14748#** Joint Publications Research Service, Arlington, Va.
**EFFECT OF PLASMA ROTATION IN TOKAMAK ON STABILIZING ACTION OF ELECTRICALLY CONDUCTING WALL Abstract Only**
L. Ye. Zakharov and S. V. Putvinskiy *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 40 Transl. into ENGLISH from Fizika Plazmy (Moscow, USSR), v. 13, no. 1, Jan. 1987 p 118-119 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14749#** Joint Publications Research Service, Arlington, Va.
**EFFECT OF PLASMA RESONANCE ON PROPERTIES OF SURFACE WAVES Abstract Only**
M. I. Bakunov, V. D. Pikulin, and N. S. Stepanov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 41 Transl. into ENGLISH from Fizika Plazmy (Moscow, USSR), v. 13, no. 1, Jan. 1987 p 62-65 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14750#** Joint Publications Research Service, Arlington, Va.
**CONFINEMENT OF ENERGY IN TOKAMAK-10 PLASMA DURING ELECTRON-CYCLOTRON-RESONANCE HEATING Abstract Only**
V. V. Alikayev, A. A. Bagdasarov, N. L. Vasin, Yu. V. Yesipchuk, A. Ya. Kislov, G. Ye. Notkin, and K. A. Razumova *In its* JPRS

Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 41-42 Transl. into ENGLISH from Fizika Plazmy (Moscow, USSR), v. 13, no. 1, Jan. 1987 p 3-19 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14751#** Joint Publications Research Service, Arlington, Va.
**LOW-FREQUENCY OSCILLATIONS IN NONIDEAL PLASMA Abstract Only**
M. A. Berkovskiy, A. A. Valuyev, and Yu. K. Kurilenkov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 42 Transl. into ENGLISH from Pisma v Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 13, no. 2, 26 Jan. 1987 p 90-94 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14752#** Joint Publications Research Service, Arlington, Va.
**SELF-ALIGNMENT OF IONS DRIFTING IN PLASMA Abstract Only**
S. A. Kazantsev, A. G. Petrashen, N. T. Polezhayeva, V. N. Rebane, and T. K. Rebane *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 43 Transl. into ENGLISH from Pisma v Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 45, no. 1, 10 Jan. 1987 p 15-17 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

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Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

**N88-14813*#** Alabama Univ., Huntsville. College of Science.
**STUDY OF SOME SUPERCONDUCTING AND MAGNETIC MATERIALS ON HIGH T SUB c OXIDE SUPERCONDUCTORS Final Report, Jun. 1985 - Sep. 1987**
M. K. Wu Oct. 1987 32 p
(Grant NAG8-032)
(NASA-CR-182330; NAS 1.26:182330) Avail: NTIS HC A03/MF A01 CSCL 20L

On the basis of existing data it appears that the high-temperature superconductivity above 77 K reported here, occurs only in compound systems consisting of a phase other than the K2NiF4 phase. A narrow superconducting transition was obtained with T sub c0 = 98 K and T sub c1 = 94 K in Y-Ba-Cu-O (YBCO). Preliminary results indicate that YBCO is rather different from the layered LaBCO, LaSCO, and LaCCO. While electron-photon interaction cannot be absent from this compound system, nonconventional enhanced superconducting interactions due to interfaces, Resonating Valence Bond (RVB) states, or even a superconducting state beyond the BCS framework, may be required to account for the high T sub c in YBCO. It is believed that study of the possible subtle correlation between magnetism and superconductivity will definitely provide important insight into the superconducting mechanism in YBCO and other oxides.
Author

**N88-14814#** Sandia National Labs., Albuquerque, N. Mex.
**THE ROLE OF HYDROGEN IN RADIATION-INDUCED DEFECT FORMATION IN POLYSILICON GATE MOS DEVICES**
J. R. Schwank, D. M. Fleetwood, P. S. Winokur, P. V. Dressendorfer, D. C. Turpin, and D. T. Sanders 1987 19 p Presented at the 24th Annual Conference on Nuclear and Space Radiation in Electronics, Snowmass, Colo., 28 Jul. 1987
(Contract DE-AC04-76DP-00789)
(DE87-012374; SAND-87-0285C; CONF-870724-7) Avail: NTIS HC A03/MF A01

The role of hydrogen in the generation of radiation-induced interface-trap and oxide-trapped charge in MOS polysilicon gate capacitors has been investigated. The concentration of radiation-induced interface-trap and oxide-trapped charge measured both immediately after irradiation and after postirradiation anneal increases if high temperature anneals are performed in hydrogen. We have analyzed these results in the context of several models of interface-trap and oxide-trapped charge formation. The mutual increase in the concentration of oxide-trapped charge and the early-time (1 msec to 10 sec) component of interface-trap charge with the amount of hydrogen used during processing suggests that the breaking of Si-H or Si-OH bonds may be responsible for much of the defect formation at or near the silicon/silicon dioxide interface. DOE

**N88-14815#** Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
**PRECIPITATION IN ALUMINA-RICH SPINEL: A TRANSFORMATION-TOUGHENED CERAMIC SINGLE CRYSTAL**
C. M. Jantzen and H. Herman (State Univ. of New York, Stony Brook.) Jul. 1987 59 p Presented at the 83rd Annual American Ceramic Society Symposium on Nucleation and Crystallization in Glasses, Washington, D.C., 3-6 May 1981, and at the 87th Annual Meeting of the American Ceramic Society, Cincinnati, Ohio, 5-9 May 1985 Submitted for publication
(Contract DE-AC09-76SR-00001)
(DE87-012380; DP-MS-87-33; CONF-810528-19; CONF-850536-14) Avail: NTIS HC A04/MF A01

The transformation of single crystal spinel supersaturated with alumina to stable alpha-Al2O3 occurs sequentially. Four metastable phases were identified in six unique phase assemblages. The appearance of a more stable decomposition product caused the reversion (dissolution) of its immediate precursor. The two early transient precipitates, I/sub P/ and II/sub P/, were identified as solute rich GP zones aligned along the same crystallographic orientations as the sequentially formed intermediate transition phases, I/sub T/ and II/sub T/. The activation energies for precipitation and reversion were measured to be approx. 80 kJ, comparable to activation energies for precipitate strengthening in other ceramic and metallic systems. The phase assemblages are represented in the context of a time-temperature-extent of transformation (TTT) diagram compiled from the work of four independent studies. The phase transformations delineated by the c-shaped rate curves on the TTT diagram are shown to correlate with measured changes in mechanical properties. DOE

**N88-14816#** Sandia National Labs., Albuquerque, N. Mex.
**THE CONSEQUENCES OF INTERGRAIN JOSEPHSON COUPLING IN CERAMIC HIGH-TEMPERATURE SUPERCONDUCTORS**
J. F. Kwak, E. L. Venturini, and D. S. Ginley 1987 8 p Presented at the 18th Conference on Superconductivity in Highly Correlated Fermion Systems, Sendai, Japan, 31 Aug. 1987
(Contract DE-AC04-76DP-00789)
(DE87-013713; SAND-87-2005C; CONF-870881-2) Avail: NTIS HC A02/MF A01

The transport and magnetic properties of the ceramic high T/sub c/ superconductors are best understood in terms of an intergranular network of Josephson junctions. The drastic drop of the critical current of such a network in small magnetic fields results in magnetically decoupled grains. Thus, magnetic hysteresis data on ceramic YBa2Cu3O7-delta actually imply an intragrain critical current density over 1 million A/sq cm at 5K. Critical current versus field data provide an estimate of the product of the penetration depth and average junction size, as well as a sensitive measure of H/sub c1/. DOE

**N88-14817#** Lawrence Livermore National Lab., Calif.
**DYNAMIC HIGH PRESSURE PROCESS FOR FABRICATING SUPERCONDUCTING AND PERMANENT MAGNETIC MATERIALS Patent Application**
W. J. Nellis, inventor (to DOE), M. B. Maple, inventor (to DOE), and T. H. Geballe, inventor (to DOE) Dec. 1986 35 p
(Contract W-7405-eng-48)
(DE88-000848; US-Patent-Appl-SN-937794) Avail: NTIS HC A03/MF A01

Shock waves directed on thin layers of materials is used to form superconducting and permanent magnetic materials with improved microstructures. DOE

**N88-14818#** Oak Ridge National Lab., Tenn.
**THEORETICAL ASPECTS OF CHANNELING, DAMAGE, AND RANGE DISTRIBUTIONS FOR LOW (keV) AND HIGH (MeV) ENERGY IMPLANTATION**
M. T. Robinson 1987 16 p Presented at the SEMATECH Strategic Planning Workshop on Advanced Ion Implantation Manufacturing Technology for the Semiconductor Industry, Oak Ridge, Tenn., 20 Jul. 1987
(Contract DE-AC05-84OR-21400)
(DE88-000949; CONF-8707120-2-Vugraphs) Avail: NTIS HC A03/MF A01

The effects of ion irradiation, ion implantation of silicon in silicon, and channeling are presented in the form of vugraphs, graphs, and charts. DOE

**N88-14819#** Oak Ridge National Lab., Tenn.
**SURFACE MODIFICATION USING ION BEAMS: RECENT DEVELOPMENTS AT ORNL**
J. B. Roberto 1987 24 p Presented at the SEMATECH Strategic Planning Workshop on Advanced Ion Implantation Manufacturing Technology for the Semiconductor Industry, Oak Ridge, Tenn., 20 Jul. 1987
(Contract DE-AC05-84OR-21400)
(DE88-000951; CONF-8707120-3-Vugraphs) Avail: NTIS HC A03/MF A01

A brief description of past and continuing research in ion implantation at ORNL is presented. Included are the objectives and motivation for research in the following areas: fabrication of high energy solar cells, direct ion beam deposition, and ion-implanted optical waveguides. DOE

**N88-14820#** California Univ., Berkeley. Lawrence Berkeley Lab.
**EXTENDING THE RANGE OF LOW ENERGY ELECTRON DIFFRACTION (LEED) SURFACE STRUCTURE DETERMINATION: CO-ADSORBED MOLECULES, INCOMMENSURATE OVERLAYERS AND ALLOY SURFACE ORDER STUDIED BY NEW VIDEO AND ELECTRON COUNTING LEED TECHNIQUES Ph.D. Thesis**
D. F. Ogletree Nov. 1986 641 p
(Contract DE-AC03-76SF-00098)
(DE88-001401; LBL-22593) Avail: NTIS HC A99/MF A01

LEED multiple scattering theory is briefly summarized, and aspects of electron scattering with particular significance to experimental measurements such as electron beam coherence, instrument response and phonon scattering are analyzed. Diffuse LEED experiments are discussed. New techniques that enhance the power of LEED are described, including a real-time video image digitizer applied to LEED intensity measurements, along with computer programs to generate I-V curves. The first electron counting LEED detector using a wedge and strip position sensitive anode and digital electronics is described. This instrument uses picoampere incident beam currents, and its sensitivity is limited only by statistics and counting times. Structural results on new classes of surface systems are presented. The structure of the c(4 x 2) phase of carbon monoxide adsorbed on Pt(111) has been determined, showing that carbon monoxide molecules adsorb in both top and bridge sites, 1.85 + or - 0.10 A and 1.55 + or - 0.10 A above the metal surface, respectively. The structure of an incommensurate graphite overlayer on Pt(111) is analyzed. The graphite layer is 3.70 + or - 0.05 A above the metal surface, with intercalated carbon atoms located 1.25 + or - 0.10 A above hollow sites supporting it. The (2 sq. rt. of 3 x 4)-rectangular phase of benzene and carbon monoxide coadsorbed on Pt(111) is analyzed. Benzene molecules adsorb in bridge sites parallel to and 2.10 + or - 0.10 A above the surface. The carbon ring is expanded, with an average C-C bond length of 1.72 + or - 0.15 A. The carbon monoxide molecules also adsorb in bridge sites. The structure of the (sq. rt. of 3 x sq. rt. of 3) reconstruction on the (111) face of the alpha-CuAl alloy has been determined. DOE

**N88-14821#** North Carolina Central Univ., Durham.
**VIBRATIONAL PROPERTIES OF DISORDERED SOLIDS. FAR INFRARED STUDIES: PERFORMANCE REPORT**
J. M. Dutta 1987 18 p
(Contract DE-FG05-84ER-45126)
(DE88-001474; DOE/ER-45126/3) Avail: NTIS HC A03/MF A01

Presented are results obtained to date and additional results expected by the termination date. A two-beam interferometer was used for the measurements of dielectric properties of various materials which includes the low-loss, birefringent crystal quartz and sapphire, several ceramics, plastics, glasses and semiconductors. Low absorption values for mono-crystalline quartz and sapphire provide a baseline with which to compare results for analogous materials which contain substantial amounts of disorder, that is, fused silica and alumina. The latter materials have losses which have several times that of the monocrystalline samples. Mechanisms which gives rise to such enhanced absorption in materials containing disorder are still largely unidentified. The effect of impurities upon the absorption is also evident. Water-free fused silica (Spectrosil-WF) has less than one-half the absorption loss of a common fused silica. The results obtained for the dielectric properties of Al2O3 materials indicate that single-crystal sapphire has the lowest loss tangent. The best ceramic alumina samples had losses of approximately a factor of 2 larger when compared to sapphire. DOE

**N88-14822#** Sandia National Labs., Albuquerque, N. Mex.
**STRUCTURE OF LAYERED CRYSTALS STUDIED BY HIGH ENERGY ION BEAMS**
S. T. Picraux, L. R. Dawson, J. Y. Tsao, B. L. Doyle, and S. R. Lee 1987 23 p Presented at the 12th International Conference on Atomic Collisions in Solids, Okayama, Japan, 12 Oct. 1987
(Contract DE-AC04-76DP-00789)
(DE88-001675; SAND-87-1752C; CONF-8710159-2) Avail: NTIS HC A03/MF A01

This paper reviews the use of MeV ion channeling techniques for the characterization of strained-layered structures. We present new results for the analysis of semiconductor heteroepitaxial surface layers and buried layers, and review previous results for strained-layer superlattices. Three inclined-direction channeling approaches are discussed: angular scans to measure the strain in the upper layers, dechanneling as a function of depth to provide a depth-resolved monitor of the strain, and catastrophic dechanneling in planes to measure small strains in superlattices. Along the growth direction we discuss the use of dechanneling by misfit dislocations to measure strain relief. DOE

**N88-14823#** California Univ., San Diego.
**ION MIXING AND SURFACE MODIFICATION IN METAL-SEMICONDUCTOR SYSTEMS Final Technical Report, 1 Aug. 1984 - 31 Jul. 1987**
S. S. Lau and J. W. Mayer 1987 22 p Prepared in cooperation with Cornell Univ., Ithaca, N.Y.
(Contract DE-FG03-84ER-45156)
(DE88-001702; DOE/ER-45156/T2) Avail: NTIS HC A03/MF A01

The objective was to understand the similarities and differences between thermal annealing (a steady-state process) behavior and ion-induced (a transient process) behavior in metal-semiconductor systems. There were three specific aspects of ion mixing in mind during the course of this investigation: Kirkendall marker motion in ion induced reactions; phase separation; and bilayered sample versus multi-layered sample. Each of the specific objectives was studied, the first issue was investigated with some details. The single most important finding in this investigation is the fact that the moving species during ion-induced reaction may be different from that during thermally induced reaction for a given system. This observation, together with the knowledge of how to change the moving species during ion mixing, enable us to design materials

of desired composition and phases not achievable with conventional means. While we have established some of the phenomenological correlations between ion induced and thermal reactions, the basic mechanisms for the change of moving species during ion-mixing requires further study. DOE

**N88-14824#** Sandia National Labs., Albuquerque, N. Mex.
**HIGH TEMPERATURE STABILITY OF SUPERCONDUCTING YBa2Cu3O SUBx AS CHARACTERIZED BY X-RAY DIFFRACTION**
M. O. Eatough, T. L. Aselage, K. D. Keefer, D. S. Ginley, and B. Morosin 1987 15 p Presented at the 36th Annual Denver X-Ray Conference, Denver, Colo., 3 Aug. 1987
(Contract DE-AC04-76DP-00789)
(DE88-001856; SAND-87-1275C; CONF-8708150-4) Avail: NTIS HC A03/MF A01

The properties of single-phase YBa2Cu3O(sub x) (x = 6.9) are characterized within the range of conventional processing temperatures. In addition, several pellets of the material were subjected to a high pressure oxygen treatment in an effort to increase oxygen content. Lattice parameter measurements were also made. At room temperature it had an orthorhombic structure with parameters near: a = 3.82A, b = 3.88A and c = 11.68A. At lower oxygen values (x less than or equal to 6.5) the structure was tetragonal with parameters near: a = 3.86 and c = 11.80. A symmetry change occurred from orthorhombic to tetragonal between 450 C and 650 C dependent on oxygen partial pressure. DOE

**N88-14825#** Lawrence Livermore National Lab., Calif.
**SILICON MICROSCALE MECHANISMS FROM (110) ORIENTED WAFERS**
D. R. Ciarlo Oct. 1987 31 p
(Contract W-7405-eng-48)
(DE88-002096; UCRL-15970; R-86-044) Avail: NTIS HC A03/MF A01

We have studied the use of (110) oriented silicon wafers for the fabrication of cantilever type accelerometers. Using this orientation, cantilevers can be fabricated such that their thickness is in a direction parallel to the wafer surface, and their width is equal to the wafer thickness. With such a design, the cantilevers deflect in a direction parallel to the wafer surface instead of perpendicular to the surface, as is the case with cantilevers fabricated from (100) oriented wafers. It might be possible to fabricate structures such as setback accelerometers and latching mechanisms with (110) silicon cantilevers. We have designed and fabricated a corner compensation structure for use with (110) oriented cantilevers. DOE

**N88-14826#** Florida State Univ., Tallahassee.
**HELIUM ATOM SURFACE SCATTERING APPARATUS FOR STUDIES OF CRYSTALLINE SURFACE DYNAMICS Progress Report, 1 May 1985 - 30 Apr. 1988**
S. A. Safron and J. G. Skofronick 1987 14 p
(Contract DE-FG05-85ER-45208)
(DE88-002104; DOE/ER-45208/3) Avail: NTIS HC A03/MF A01

The primary goal of this grant was the construction of a state-of-the-art He atom-surface spectroscopy (HASS) scattering instrument capable of determining both structure and dynamics of metal, insulator and semiconductor surfaces. The method measures the elastic and inelastic scattering of He atoms from the crystal surface as a function of angle and energy gains or losses. The project was begun on May 1, 1985, and this report covers the progress from inception to present. The nozzle beam has been characterized, both before and after scattering from a LiF crystal surface, and angular distributions from this surface have also been taken. In addition to the specular and Bragg peaks, fine structure between the peaks is shown to be due to various inelastic collision processes reported previously. Current efforts are to measure the inelastic processes by time-of-flight methods so as to repeat the previous surface dispersion measurements. DOE

**N88-14827#** Sandia National Labs., Albuquerque, N. Mex.
**EFFECT OF HIGH PRESSURE OXYGEN LOADING ON THE SUPERCONDUCTIVITY OF La2CuO4**
J. E. Schirber, J. F. Kwak, E. L. Venturini, B. Morosin, D. S. Ginley, W. S. Fu, and R. J. Baughman 1987 7 p Presented at the 18th Conference on Low Temperature Physics, Kyoto, Japan, 20 Aug. 1987
(Contract DE-AC04-76DP-00789)
(DE88-002108; SAND-87-2498C; CONF-870873-17) Avail: NTIS HC A02/MF A01

This report shows that high-pressure oxygen treatment can increase the amount of superconducting material in La CuO to over the one percent level (to date). The observed superconducting fraction suggests that the superconductivity is a bulk, rather than intergrain, phenomenon. Since no alkaline earth substitution for La is involved, this would imply that arguments based on substituent ion size are incorrect. DOE

**N88-14828#** Brookhaven National Lab., Upton, N. Y.
**PHOTON STIMULATED DESORPTION FROM OXIDIZED Al(110)**
E. D. Johnson, R. F. Garrett, M. L. Knotek, and F. Sette 1987 7 p Presented at the 3rd International Workshop on Desorption Induced by Electronic Transitions, Shelter Island, N.Y., 20 May 1987 Prepared in cooperation with Bell Telephone Labs., Inc., Murray Hill, N.J.
(Contract DE-AC02-76CH-00016)
(DE88-002209; BNL-40333; CONF-8705194-3) Avail: NTIS HC A02/MF A01

We have studied oxide films on Al(110) by photon stimulated desorption (PSD) on the Bell Labs U4 PGM at the National Synchrotron Light Source. Utilizing a time of flight technique we have obtained ion energy distribution (IED) and relative ion yield (RIY) data at the Al 2p and O 1s edges for oxides prepared at various temperatures. These initial studies suggest that different sites for the surface hydroxyls exist, that they can be selectively prepared, and examined by PSD. DOE

**N88-14829#** California Univ., Berkeley. Lawrence Berkeley Lab.
**ELECTRONIC BAND STRUCTURE AND PHOTOEMISSION: A REVIEW AND PROJECTION**
L. M. Falicov Sep. 1987 10 p Presented at the 14th International Conference on X-Ray and Inner-Shell Processes, Paris, France, 14 Sep. 1987 Prepared in cooperation with Nordisk Inst. for Teoretisk Atomfysik, Copenhagen, Denmark
(Contract DE-AC03-76SF-00098)
(DE88-002236; LBL-23976; CONF-8709135-5) Avail: NTIS HC A02/MF A01

A brief review of electronic-structure calculations in solids, as a means of interpreting photoemission spectra, is presented. The calculations are, in general, of three types: ordinary one-electron-like band structures, which apply to bulk solids and are the basis of all other calculations; surface modified calculations, which take into account, self-consistently if at all possible, the presence of a vacuum-solid interface and of the electronic modifications caused thereby; and many-body calculations, which go beyond average-field approximations and consider dynamic rearrangement effects caused by electron-electron correlations during the photoemission process. DOE

**N88-14830#** California Univ., Berkeley. Lawrence Berkeley Lab.
**MACROSCOPIC QUANTUM EFFECTS IN A JOSEPHSON TUNNEL JUNCTION**
J. Clarke, A. N. Cleland, M. H. Devoret, D. Esteve, and J. M. Martinis May 1987 13 p Presented at the 9th International Conference on Noise in Physical Systems, Montreal, Quebec, 25 May 1987
(Contract DE-AC03-76SF-00098)
(DE88-002239; LBL-23679; CONF-8705117-2) Avail: NTIS HC A03/MF A01

This paper discusses the observation of quantum effects in the macroscopic system of a Josephson tunnel junction. The macroscopic degree of freedom is the phase difference delta between the phases of the order parameters in the two superconductors on either side of the tunnel barrier. As we shall see, the anharmonicity enables us to observe the quantized energy levels because they are no longer equally spaced, and to observe the zero point motion by the demonstration that the system tunnels out of its initial state. DOE

**N88-14831#** Sandia National Labs., Albuquerque, N. Mex.
**ATOMIC-LEVEL STUDIES OF SUPERCONDUCTING YBa2Cu3O SUB 7-x**
G. L. Kellogg and S. S. Brenner 1987 6 p Presented at the Thin Film Processing and Characterization of High Temperature Superconductors, Anaheim, Calif., 6 Nov. 1987
(Contract DE-AC04-76DP-00789)
(DE88-002522; SAND-87-2175C; CONF-871178-1) Avail: NTIS HC A02/MF A01

The transmission electron microscope, field ion microscope, and imaging atom-probe mass spectrometer have been used to examine the structure and composition of field-emitter tips prepared from hot-pressed samples of YBa Cu O sub 7-x. Transmission electron microscope images of the tip apex clearly show periodic defect structures which are interpreted as twins boundaries. Field ion microscope images reveal the structure of the samples in atomic resolution and indicate that the material can be field evaporated in a uniform, layer-by-layer fashion. Imaging atom-probe mass spectra contain signals corresponding to all of the constituent elements with intensities fairly consistent with the 1-2-3 ratio of the metals, but highly deficient in oxygen. DOE

**N88-14832*#** North Carolina Agricultural and Technical State Univ., Greensboro. Dept. of Electrical Engineering.
**HETEROEPITAXIAL GROWTH OF 3-5 SEMICONDUCTOR COMPOUNDS BY METAL-ORGANIC CHEMICAL VAPOR DEPOSITION FOR DEVICE APPLICATIONS Final Report, Oct. 1983 - Aug. 1987**
Ward J. Collis and Ali Abul-Fadl Jan. 1988 11 p
(Grant NAG1-403)
(NASA-CR-182346; NAS 1.26:182346) Avail: NTIS HC A03/MF A01 CSCL 20L

The purpose of this research is to design, install and operate a metal-organic chemical vapor deposition system which is to be used for the epitaxial growth of 3-5 semiconductor binary compounds, and ternary and quaternary alloys. The long-term goal is to utilize this vapor phase deposition in conjunction with existing current controlled liquid phase epitaxy facilities to perform hybrid growth sequences for fabricating integrated optoelectronic devices. Author

**N88-14833#** Science Research Council, Daresbury (England).
**COVERAGE DEPENDENCE OF ADSORBATE-SUBSTRATE BOND LENGTHS: CHLORINE AND CAESIUM ADSORBED ON SILVER SINGLE CRYSTALS**
G. M. Lamble, D. J. Holmes, D. A. King, and D. Norman Aug. 1986 10 p Prepared in cooperation with Liverpool Univ., United Kingdom
(PB87-125142; DL/SCI/P-529E) Avail: NTIS HC E03/MF E03 CSCL 20L

SEXAFS has been employed to investigate several submonolayer phases of Cl and Cs adsorbed on various single-crystal silver planes. For chlorine adsorption, the nearest-neighbor bond distance is found to be invariant with coverage. In complete contrast, a dramatic increase in the substrate-adsorbate bond length is observed with increase in coverage of Cs. This different behavior of Cl and Cs adsorbates is discussed in terms of the electron transfer processes between electronegative and electropositive adsorbates and the substrate. GRA

**N88-14834#** Science Research Council, Daresbury (England).
**INVESTIGATION OF THE PERFORMANCE OF A NOVEL DOUBLE CRYSTAL X-RAY MONOCHROMATOR MEASUREMENTS**
B. R. Dobson, S. S. Hasnain, M. Hart, M. J. vanderHoek, and P. vanZuylen Sep. 1986 8 p Prepared in cooperation with Technisch Physische Dienst TNO-TH, Delft, Netherlands
(PB87-125167; DL/SCI/P-532E) Avail: NTIS HC E03/MF E03 CSCL 20L

A new double crystal X-ray monochromator for EXAFS and XANES measurements is described. The monochromator is designed to provide high intensity with good resolution by the use of bent crystals, when used on line 8 of the Daresbury Synchrotron Radiation Source. The details of the monochromator design have been reported. Examples of EXAFS spectra demonstrate the success of the design. Further aspects of the performance are considered. The stability of the monochromator, its ability to remove harmonics from the monochromatic beam, and the use of doubly bent crystals to provide focussing are reported. Finally, the appearance of anomalies in the output of the monochromator is shown to arise from multiple diffraction effects. These effects and efforts to minimize or remove them are discussed. GRA

**N88-14835*** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**METHOD FOR INVESTIGATING THE FORMATION OF CRYSTALS IN A TRANSPARENT MATERIAL Patent**
William F. Kaukler, inventor (to NASA) (Universities Space Research Association, Columbia, Md.) 8 Dec. 1987 11 p Filed 21 Nov. 1985
(NASA-Case-MFS-26008-1-CU; US-Patent-4,711,697;
US-Patent-Appl-SN-800194; US-Patent-Class-156-621;
US-Patent-Class-156-622; US-Patent-Class-156-624;
US-Patent-Class-422-251; US-Patent-Class-422-260) Avail: US Patent and Trademark Office CSCL 20L

The observation of crystal formation in a transparent specimen is described. A portion of the specimen is melted in a heating zone, then frozen by a cooling zone, which is spaced from the heating zone by a gap, which can be kept under observation. The temperatures of the heating and cooling zones are controlled to create a variable temperature gradient across the gap so that the freezing isotherm of the specimen always remains in a substantially constant position within the gap, where it can be observed, and where the specimen can be moved longitudinally while the temperature gradient is changed.
Official Gazette of the U.S. Patent and Trademark Office

**N88-14836*** National Aeronautics and Space Administration. Pasadena Office, Calif.
**TAILORABLE INFRARED SENSING DEVICE WITH STRAIN LAYER SUPERLATTICE STRUCTURE Patent**
Li-Jen Cheng, inventor (to NASA) (California Inst. of Tech., Pasadena.) 8 Dec. 1987 10 p Filed 28 Aug. 1986 Supersedes N87-15883 (25 - 07, p 975)
(NASA-Case-NPO-16607-1-CU; US-Patent-4,711,857;
US-Patent-Appl-SN-901114; US-Patent-Class-437-3;
US-Patent-Class-437-7; US-Patent-Class-437-8;
US-Patent-Class-437-128; US-Patent-Class-437-131;
US-Patent-Class-437-969; US-Patent-Class-357-30) Avail: US Patent and Trademark Office CSCL 20L

An infrared photodetector is formed of a heavily doped p-type Ge sub x Si sub 1-x/Si superlattice in which x is pre-established during manufacture in the range 0 to 100 percent. A custom-tailored photodetector that can differentiate among close wavelengths in the range of 2.7 to 50 microns is fabricated by appropriate selection of the alloy constituency value, x, to establish a specific wavelength at which photodetection cutoff will occur.
Official Gazette of the U.S. Patent and Trademark Office

**N88-14837#** Rome Univ. (Italy). Dipt. di Fisica.
**L2,3 XANES OF THE HIGH T SUB c SUPERCONDUCTOR YBa2Cu3O7 WITH VARIABLE OXYGEN CONTENT**
A. Bianconi, A. CongiuCastellano, M. DeSantis, P. Rudolf, P.

Lagarde, A. M. Flank (Paris-Sud Univ., Orsay, France ), and A. Marcelli 19 Jun. 1987 29 p Presented at the Symposium on High T sub c Superconductivity at the 7th General Conference of the Condensed Matter Division of the European Physical Society, Pisa, Italy, 8 Apr. 1987 Submitted for publication
(Nota-Interna-888; ETN-88-91249) Avail: NTIS HC A03/MF A01

The copper L(2,3) soft X-ray absorption spectra of the single phase high temperature (Tc=91 K) superconductor YBa2Cu3O7 were measured using synchrotron radiation. The spectra show at the absorption threshold a white line at 931.1 eV due to Cu 2p3d(10) final states for the Cu 3d(9) initial state, and a broad high energy shoulder with the maximum at 933 eV assigned to Cu 2p3d(10)L and to Cu 2p3d(10)L 4s(1) final states (L indicates a hole in the oxygen 2p derived valence band), i.e., to the initial states 3d(9)L and 3d(10)L. The intensity of this last feature decreases with decreasing oxygen content x in YBa2Cu3O6.5+x. No evidence of Cu 2p3d(9) final states is found. This experiment gives direct evidence that additional oxygen x does not give Cu(3+) ions with Cu 3d(8) configuration but gives 3d(9)L electronic configuration (i.e., Cu(2+)O(-) pairs) and no gap is observed between the 3d(9)(Cu+) and 3d(10)L configuration (i.e., Cu(+)O(-) pairs. Therefore in the metallic phase which exhibits superconductivity a continous set of itinerant states 3d(9)L and 3d(10)L is observed. ESA

**N88-14838#** Technische Hogeschool, Eindhoven (Netherlands).
**THE INFLUENCE OF PHOSPHORUS ON THE SOLID STATE REACTION BETWEEN COPPER AND SILICON OR GERMANIUM Ph.D. Thesis**
Johanna Geertruida M Becht 1987 165 p Sponsored by the Netherlands Foundation for Chemical Research, and the Netherlands Organization for the Advancement of Pure Research
(ETN-88-91361) Avail: NTIS HC A08/MF A01

The influence of a trace of a third element on the reaction in a binary system, i.e., the solid state reaction between cooper and silicon in diffusion couples, was studied. If a trace of phosphorus is present in copper, the incubation time disappears and the grain boundary diffusion mechanism is operative until 530C. This incubation time is due to an oxide layer on the silicon, which is removed by segregation of phosphorus to the reaction interface. In the absence and in the presence of phosphorus the only reaction product is Cu3Si, although the phase diagram also predicts the formation of Cu15Si4 and Cu5Si. The reaction between copper and germanium is not influenced by the presence of phosphorus, or by the applied compressive stress. The reaction is diffusion limited, no incubation times are found. Copper diffuses with a bulk diffusion mechanism between 400 and 570C. Germanium oxide does not hinder the reaction with copper, while silicon oxide is an effective diffusion barrier for copper. ESA

**N88-14839#** University of Southern California, Los Angeles. Dept. of Materials Science.
**SOME INVESTIGATIONS OF MOLECULAR BEAM EPITAXIAL GROWTH OF 3-5 SEMICONDUCTOR FILMS VIA MONTE-CARLO COMPUTER SIMULATIONS, CARRIER TUNNELLING AND SPECTROSCOPIC ELLIPSOMETRY Final Status Report, 15 Apr. 1983 - 14 May 1986**
A. Madhukar 5 Aug. 1987 28 p
(Contract F49620-83-C-0074)
(AD-A185520; AFOSR-87-1331TR) Avail: NTIS HC A03/MF A01 CSCL 20L

It has been obvious for some time that the USC MBE (Molecular Beam Epitaxy) facility required major effort and investment to be able to grow reliable samples. To achieve this aim, major effort was spent making the USC MBE machine operational and putting in place basic support facilities (such as substrate cleaning and preparation). The few GaAs/A1x Ga1-xAs/GaAs tunnelling structures fabricated with which Fowler-Norheim resonance tunnelling experiments were carried out at JPL indicated that the interfacial quality of these structures were of poor quality. GRA

**N88-14840#** Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.
**ANALYTICAL INVESTIGATIONS OF BULK WAVE RESONATORS IN THE PIEZOELECTRIC THIN FILM ON GALLIUM-ARSENIDE CONFIGURATION Final Report, 1 Sep. 1984 - 31 May 1987**
Harry F. Tiersten 28 Jul. 1987 71 p
(Grant AF-AFOSR-0351-84)
(AD-A185716; AFOSR-87-1233TR) Avail: NTIS HC A04/MF A01 CSCL 09E

Trapped energy modes in the piezoelectric thin film on semiconductor composite resonator are explained and contrasted with modes that do not trap energy. The results of calculations of the quality factor of the fundamental essentially thickness-extensional mode in the composite resonator due to radiation into the bulk semiconductor wafer are discussed. The combination of materials considered was aluminum-nitride on gallium-arsenide. The calculations show that when trapping is not present the quality factor is a very rapidly varying function of the ratio of the composite resonator thickness to the wafer thickness and that the range of variation is very large, i.e., between one and two orders of magnitude. The calculations also reveal that when trapping is present the quality factor is always much larger and its range of variation with thickness ratio much smaller than when trapping is not present. The direct calculation procedure is required to check the accuracy of a perturbation procedure. The perturbation procedure for the calculation of the quality factor of the composite resonator due to radiation into the semiconductor wafer is discussed. The perturbation procedure enables calculations for the case of rectangular electrodes and diaphragms to be performed. For the strip case the calculations of the quality factor using the perturbation procedure are in good agreement with the results obtained from the earlier more cumbersome direct procedure. GRA

**N88-14841#** Utrecht State Univ. (Netherlands). Dept. of Computer Science.
**VERY THIN VLSI-LAYOUTS (VERY LARGE SCALE INTEGRATION-LAYOUTS) OF COMPLETE BINARY TREES**
J. vanLeeuwen and R. B. Tan Jun. 1986 18 p
(PB88-100847; RUU-CS-86-7) Avail: NTIS HC A03/MF A01 CSCL 20L

Described is a minimum area VLSI-layout of a complete binary tree T sub k with all (2 sup k) leaves on one edge of a rectangular chip. The layout has the following additional properties: (1) there are no wire-crossings; (2) the root of the tree is accessible; and (3) it has minimum possible width. It is shown that any minimum area VLSI-layout of T sub k, with all leaves collinear must have width (k/2) + 1 and length (2 sup k) + 2 sup((k/2) - 1) for k even and (2 sup k) + 2 sup ((k/2)-1)(1 + (k/2)) for k odd. GRA

**N88-14134#** Joint Publications Research Service, Arlington, Va.
**PRESSURE INDUCED PHASE TRANSITIONS, SUPERCONDUCTIVITY OF PHOSPHORUS DESCRIBED**
Ichimin Shirotani and Haruki Kawamura *In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 40-50 Transl. into ENGLISH from Kino Zairyo (Tokyo, Japan), Mar. 1987 p 56-63 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

**N88-14214#** Joint Publications Research Service, Arlington, Va.
**HITACHI DEVELOPS CERAMIC SUPERCONDUCTING DEVICE Abstract Only**
*In its* JPRS Report: Science and Technology. Japan 23 Sep. 1987 p 1 Transl. into ENGLISH from Kyodo (Tokyo, Japan), 11 Aug. 1987 (For primary document see N88-14213 06-31)
Avail: NTIS HC A05/MF A01

**N88-14215#** Joint Publications Research Service, Arlington, Va.
**RECENT TRENDS IN SUPERCONDUCTOR DEVELOPMENT DISCUSSED**

Hideo Ihara *In its* JPRS Report: Science and Technology. Japan 23 Sep. 1987 p 2-16 Transl. into ENGLISH of Shin Kinzoku Kogyo (Tokyo, Japan), 1986 p 1-8 (For primary document see N88-14213 06-31)
Avail: NTIS HC A05/MF A01

**N88-14217#** Joint Publications Research Service, Arlington, Va.
**SUPERCONDUCTING MATERIAL DEVELOPMENT Abstract Only**
*In its* JPRS Report: Science and Technology. Japan 23 Sep. 1987 p 30 Transl. into ENGLISH from Japanese Journal of Applied Sciences (Tokyo, Japan), 4 Aug. 1987 (For primary document see N88-14213 06-31)
Avail: NTIS HC A05/MF A01

**N88-14732#** Joint Publications Research Service, Arlington, Va.
**POPULATION INVERSION IN GAPLESS SEMICONDUCTORS AS RESULT OF INTERBAND PUMPING Abstract Only**
G. M. Genkin, A. V. Okomelkov, and I. D. Tokman *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 6 Transl. into ENGLISH from Pisma v Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 13, no. 1, 12 Jan. 1987 p 32-35 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

# 77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

**N88-14842#** Rome Univ. (Italy). Dipartimento di Fisica.
**RELATIVISTIC STOCHASTIC MECHANICS**
Maurizio Serva 16 Feb. 1987 27 p
(Preprint-543; ETN-88-91256) Avail: NTIS HC A03/MF A01

A relativistic extension of stochastic mechanics is proposed. The starting point is the construction of relativistically covariant diffusions satisfying a property similar but not identical to the Markov property. It is shown that the continuity equation associated with these processes together with the relativistic version of the mean Newton equation are equivalent to the Klein-Gordon equation. ESA

**N88-14843#** Rome Univ. (Italy). Dipartimento di Fisica.
**BREAKING OF SUPERSYMMETRY DEGENERACY AND PHENOMENOLOGICAL CONDITIONS**
M. Milekovic and S. Pallua 12 May 1987 10 p Sponsored in part by the Self-Managing Community of Interest for Science of the Socialistic Republic of Croatia and Istituto Nazionale di Fisica Nucleare, Rome, Italy
(Contracts INT-8509367; YOR-84/078; YOR-82/051)
(Preprint-559; ETN-88-91272) Avail: NTIS HC A02/MF A01

The supersymmetric potential in the presence of soft and temperature dependent supersymmetry breaking terms is analyzed. Compatibility with phenomenological conditions rules out the SU(5) model with the 75 dimensional Higgs field and allows the SU(5) model with the 24 dimensional Higgs only in a restricted region of parameters. ESA

**N88-14844#** Rome Univ. (Italy). Dipartimento di Fisica.
**GROUP QUANTIZATION OF CONSTRAINED SYSTEMS**
Carlo Rovelli 9 Jul. 1987 16 p
(Preprint-564; ETN-88-91276) Avail: NTIS HC A03/MF A01

The Isham-Kirillov group theoretical quantization method was modified in order to treat constrained systems. This prescription overcomes problems left open by the Dirac method, and in particular the problem of the definition of the physical scalar product on the space of the physical states. The possibility of using the group quantization for dealing not only with the kinematics, but also with the dynamics of the system is considered. ESA

**N88-14845#** Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
**MODIFIED QUANTUM MECHANICS OF SMALL COMPOSITE SYSTEMS**
G. F. Wolters Dec. 1986 36 p
(NIKHEF-H/87-1; B8709439; ETN-88-91333) Avail: NTIS HC A03/MF A01

Boundary conditions on radial wave functions for a particle bound by a central potential are considered. It is argued that the usual condition at the origin needs modification for systems of small intrinsic size. This affects s-states, especially the ground state. With the obtained modification the theorem is imposed rather than derived. The central rectangular well potential is treated and applied to the nucleon. Its soft electromagnetic structure can be largely explained while quark confinement holds despite moderate strength of the potential. ESA

# 80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

**N88-14887*#** Prairie View Agricultural and Mechanical Coll., Tex. Honors Coll.
**A STUDY OF THE MINORITY COLLEGE PROGRAMS AT THE NASA JOHNSON SPACE CENTER Final Report**
Mfanya Donald Tryman *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 20 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 05K

# 81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

**N88-14846*** National Aeronautics and Space Administration, Washington, D.C.
**UNIVERSITY PROGRAM MANAGEMENT INFORMATION SYSTEM, FISCAL YEAR 1985**
1985 383 p
(NASA-TM-88381; NAS 1.15:88381) Avail: NTIS HC $32.00 CSCL 05A

The University Program Report provides current information and related statistics for approximately 4200 grants/contracts/cooperative agreements active during the reporting period. NASA Field Centers and certain Headquarters Program Offices provide funds for those research and development activities in universities which contribute to the mission needs of that particular NASA element. This annual report is one means of documenting the NASA-University relationship, frequently denoted, collectively, as NASA's University Program. Author

**N88-14847*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**STRATEGIC MANAGEMENT OF RESEARCH AND DEVELOPMENT: A LITERATURE SEARCH**
Carol K. Sterkin, comp. 15 Jan. 1988 67 p
(NASA-CR-182337; JPL-D-5099; NAS 1.26:182337) Avail: NTIS HC A04/MF A01 CSCL 05A

Each abstract was reviewed as to its described contents and potential applicability to the topics expected to be addressed at the 1988 National Conference on strategic management of research and development. In each section the citations are listed alphabetically by senior or corporate author. The names, addresses, and telephone numbers of organizations from which the listed material may be requested, are provided. B.G.

**N88-14135#** Joint Publications Research Service, Arlington, Va.
**NAL NEWS UPDATED: FY87 BUSINESS PLAN, DEVELOPMENTS**
*In its* JPRS Report: Science and Technology. Japan 6 Oct. 1987 p 51-61 Transl. into ENGLISH from Kogiken Nyusu (Tokyo, Japan), May 1987 p 1-14 (For primary document see N88-14130 06-23)
Avail: NTIS HC A06/MF A01

# 82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.

For computer documentation see *61 Computer Programming and Software.*

**N88-14848#** Vrije Universiteit, Amsterdam (Netherlands). Subfaculteit Wiskunde en Informatica.
**USING USER MODELS AND AUTOMATIC EXPERTISE ACQUISITION IN DATA BASE INTERACTIONS**
A. M. Botman and A. J. Kok Dec. 1986 13 p
(PB87-234357; IR-121) Avail: NTIS HC A03/MF A01 CSCL 05B

A method is proposed for retrieving information from a data base based on knowledge about the user collected during interaction with him. A first version was built of an intelligent system that automatically acquires expertise about the users, and the domain with which it works. From the interaction with the user, the system builds a model of the user's interests. Of interest, it is assumed that the user cannot give a complete picture of his preferences, and therefore his statements are taken only as indications and never considered fully exact. In particular, contradictions by the user are acceptable. Subsequently, the information of greatest interest to the user is presented. The system requires less interaction with the user than other, conventional, interaction programs. GRA

**N88-14849#** Oak Ridge Gaseous Diffusion Plant, Tenn.
**BAR CODE DOCUMENT ACCOUNTABILITY SYSTEM PERFORMANCE UPDATE**
D. J. Wade and P. J. Mountain 1987 37 p Presented at the Micrographic and Information Management Conference, Boulder, Colo., 3 Nov. 1987
(Contract DE-AC05-84OT-21400)
(DE88-002256; K/CSD/INF-87-23; CONF-871132-1) Avail: NTIS HC A03/MF A01

This paper contains an up-to-date summary of the Bar Code Document Accountability System (BARDAS). BARDAS was developed to demonstrate the feasibility of improving the management and reporting timeliness of secret document inventories by the accountable custodians at the Department of Energy's Oak Ridge and Paducah plants. This paper discusses enhancements to the BARDAS and the use of bar code technology in accomplishing these enhancements. DOE

**N88-14850#** Science Research Council, Chilton (England).
**SCIENTIFIC DATA MANIPULATION IN A RELATIONAL DATABASE SYSTEM**
B. J. Read Jul. 1986 10 p
(PB87-124400; RAL-86-084) Avail: NTIS HC E03/MF E03 CSCL 05B

Provided the user interface is well designed, extended relational algebra can be a powerful tool for handling scientific data. Its utility is greatly enhanced by the addition of attribute algebra to allow mathematical manipulation of field values. The paper reports on a development which, motivated by practical requirements, integrates features such as functions, vector data types, iteration and conditional attribute values into a relational database management system. GRA

**N88-14851#** Foersvarets Forskingsansalt, Stockholm (Sweden).
**GEOGRAPHIC APPLICATION OF THE RELATIONAL DATA BASE SYSTEM CANTOR**
M. Stjernberg Oct. 1986 57 p In SWEDISH
(PB87-120945; FOA-C-20627-2.7) Avail: NTIS HC E04/MF E01 CSCL 05B

The aim of the study was to investigate whether the existing computer program for geographic data base processing used by FOA 2 could be replaced by the relational data base system Cantor. The study showed that all types of data processing feasible in the RSAW program are also feasible in Cantor. Author

**N88-14852** California Univ., Los Angeles.
**BIBLIOGRAPHIC RELATIONSHIPS: TOWARD A CONCEPTUAL STRUCTURE OF BIBLIOGRAPHIC INFORMATION USED IN CATALOGING Ph.D. Thesis**
Barbara Ann Barnett Tillett 1987 330 p
Avail: Univ. Microfilms Order No. DA8721068

The study provides the groundwork for understanding the conceptual structure of the library catalog in terms of bibliographic relationships. The research consists of an analytical study and an empirical study. The former looks at various devices used in the past for relating bibliographic entities, as documented in 24 sets of cataloging codes, from Panizzi's 91 Rules through the second edition of the Anglo-American Cataloging Rules, and considers both the historical rationale for the devices and their importance in the design process for future catalogs and cataloging codes. To achieve this end, it operationally identifies and categorizes bibliographic relationships in a taxonomy. The seven types of bibliographic relationships are: equivalence, derivative, descriptive, whole-part, accompanying, sequential, and shared characteristic. The empirical study shows frequencies of occurrence of bibliographic relationships in the 1968 to July 1986 machine-readable database of the Library of Congress and correlates frequencies with five factors: bibliographic format, general subject, publication date, language, and country of publication. Dissert. Abstr.

**N88-14853#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
**COMMUNICATIONS FOR THE DTroll DISTRIBUTED DATABASE SYSTEM M.S. Thesis**
Michael F. Jervis, Sr 1986 50 p
(AD-A185579; AFIT/CI/NR-87-70T) Avail: NTIS HC A03/MF A01 CSCL 05B

This report is intended to describe communications concepts for the DTroll JKim,85 & Mage,86 distributed database system. The report addressed the subject matter with the assumption that the reader has a basic background knowledge of UNIX (UNIX is a trademark of Bell Laboratories). For a detailed and in-depth understanding of the background and concepts surrounding the DTROLL system, the reader is encouraged to obtaing the references listed at the end of this report. In addition, informal documents are available through the project office. This paper is presented in three parts, Chapter 1 discussed the background and general structure of Dtroll, as well as establishing some of the foundation for the remainder of the paper. Chapter 2 describes the software module for establishing a client's communication. Due to the similarity of INITSERVSOCKET and RQSTCONNECT, Chapter 2 and Chapter 3 contain a significant amount of repetitous information. This is intentional to provide continuity and ease of understanding. GRA

**N88-14242#** Geophysical Observatory, Sodankyla (Finland).
**DESCRIPTION OF DATA HANDLING SYSTEM INSTALLED DECEMBER 11, 1986**
Anna-Liisa Turunen *In* Oulu Univ., Report of the 3rd Finnish EISCAT Workshop Mar. 1987 p 73-75 (For primary document see N88-14233 06-32)
Avail: NTIS HC A05/MF A01

**N88-14243#** Finnish Meteorological Inst., Helsinki. Div. of Geomagnetism.
**VIKING QUICK LOOK PLOTS: A SHORT DESCRIPTION [VIKING-SATELLIITIN TULOKSISTA JA NIIDEN HYVAEKSIKAEYTOESTAE EISCAT-TUTKIMUKSESSA]**
Risto Pellinen *In* Oulu Univ., Report of the 3rd Finnish EISCAT Workshop Mar. 1987 p 79-90 Partly in FINNISH and ENGLISH (For primary document see N88-14233 06-32)
Avail: NTIS HC A05/MF A01

**N88-14505*#** Soviet Geophysical Committee, Moscow (USSR).
**THE ARCHIVING OF METEOR RESEARCH INFORMATION**
V. A. Nechitailenko *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 22-30 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 05B

**N88-14859*#** Illinois State Univ., Normal. Dept. of Applied Computer Science.
**A REVIEW OF HYPERTEXT IN A NASA PROJECT MANAGEMENT CONTEXT Final Report**
Christopher J. Bell *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 12 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 12 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 05B

# 83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

# 84 LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

**N88-14854#** Committee on Science, Space and Technology (U.S. House).
**THE 1988 NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA) AUTHORIZATION**
Washington GPO 1987 1206 p Hearings before the Subcommittee on Space Science and Applications of the Committee on Science, Space and Technology, 100th Congress, 1st Session, No. 35, Vol. 2, 5, 24-25 Feb.; 3, 5, 10-11, 18-19, 31 Mar.; 23 Apr. and 6 May 1987
(GPO-76-600) Avail: Subcommittee on Space Science and Applications

The fiscal year 1988 budget request is examined for the National Aeronautics and Space Administration programs which include: orbital space station; resumption of shuttle flights; expendable launch vehicles (ELVs); research and development; space transportation system; construction; and Advanced Communication Technology Satellite (ACTS). B.G.

# 85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see also *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

**N88-14855*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)/AMERICAN SOCIETY FOR ENGINEERING EDUCATION (ASEE) SUMMER FACULTY FELLOWSHIP PROGRAM, 1987. VOLUME 1 Final Reports**
William B. Jones, ed. (Texas A&M Univ., College Station.) and Stanley H. Goldstein, ed. Nov. 1987 326 p Program held in Houston, Tex., 1987; sponsored by NASA, Johnson Space Center, Houston, Tex. and Texas A/M Univ., College Station
(Grant NGT-44-001-800)
(NASA-CR-172009-Vol-1; NAS 1.26:172009-Vol-1) Avail: NTIS HC A15/MF A01 CSCL 05A

The objective of the NASA/ASEE program were: (1) to further the professional knowledge of qualified engineering and science faculty members; (2) to stimulate an exchange of ideas between participants and NASA; (3) to enrich and refresh the research and teaching activities of participants' institutions; and (4) to contribute to the research objectives of the NASA centers. Each faculty fellow spent 10 weeks at Johnson Space Center engaged in a research project commensurate with his/her interests and background and worked in collaboration with a NASA/JSC colleague. A compilation is presented of the final reports on the research projects done by the fellows during the summer of 1987. This is volume 1 of a 2 volume report. For individual titles, see N88-14856 through N88-14873.

**N88-14856*#** Texas A&M Univ., College Station. Dept. of Home Economics.
**THE DETERMINATION OF NUTRITIONAL REQUIREMENTS FOR SAFE HAVEN FOOD SUPPLY SYSTEM (EMERGENCY/SURVIVAL FOODS) Final Report** **c54**
Selina Ahmed *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 18 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 18 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 06H

The Space Station Safe Haven Food System must sustain 8 crew members under emergency conditions for 45 days. Emergency Survival Foods are defined as a nutritionally balanced collection of high density food and beverages selected to provide for the survival of Space Station flight crews in contingency situations. Since storage volume is limited, the foods should be highly concentrated. A careful study of different research findings regarding starvation and calorie restricted diets indicates that a minimum nutritional need close to RDA is an important factor for sustaining an individual's life in a stressful environment. Fat, protein, and carbohydrates are 3 energy producing nutrients which play a vital role in the growth and maintenance process of human life. A lower intake of protein can minimize the water intake, but it causes a negative nitrogen balance and a lower performance level. Other macro and micro nutrients are also required for nutritional interrelationships to metabolize the other 3 nutrients to their optimum level. The various options for longer duration than 45 days are under investigation. Author

**N88-14857*#** Norwich Univ., Northfield, Vt. Dept. of Computer Science Engineering.
**LIFE SCIENCES FLIGHT EXPERIMENTS MICROCOMPUTER Final Report** **c60**
Peter N. Bartram *In* NASA. Lyndon B. Johnson Space Center,

Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 10 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 10 p (SEE N88-14855 06-85)

Avail: NTIS HC A15/MF A01 CSCL 09B

A promising microcomputer configuration for the Spacelab Life Sciences Lab. Equipment inventory consists of multiple processors. One processor's use is reserved, with additional processors dedicated to real time input and output operations. A simple form of such a configuration, with a processor board for analog to digital conversion and another processor board for digital to analog conversion, was studied. The system used digital parallel data lines between the boards, operating independently of the system bus. Good performance of individual components was demonstrated: the analog to digital converter was at over 10,000 samples per second. The combination of the data transfer between boards with the input or output functions on each board slowed performance, with a maximum throughput of 2800 to 2900 analog samples per second. Any of several techniques, such as use of the system bus for data transfer or the addition of direct memory access hardware to the processor boards, should give significantly improved performance. Author

**N88-14858*#** Texas Southern Univ., Houston. Dept. of Computing and Applied Sciences.

**HEURISTIC CONTROL OF THE UTAH/MIT DEXTROUS ROBOT HAND Final Report** **c37**

Andrew H. Bass, Jr. *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 20 p (SEE N88-14855 06-85)

Avail: NTIS HC A15/MF A01 CSCL 13I

Basic hand grips and sensor interactions that a dextrous robot hand will need as part of the operation of an EVA Retriever are analyzed. What is to be done with a dextrous robot hand is examined along with how such a complex machine might be controlled. It was assumed throughout that an anthropomorphic robot hand should perform tasks just as a human would; i.e., the most efficient approach to developing control strategies for the hand would be to model actual hand actions and do the same tasks in the same ways. Therefore, basic hand grips that human hands perform, as well as hand grip action were analyzed. It was also important to examine what is termed sensor fusion. This is the integration of various disparate sensor feedback paths. These feedback paths can be spatially and temporally separated, as well as, of different sensor types. Neural networks are seen as a means of integrating these varied sensor inputs and types. Basic heuristics of hand actions and grips were developed. These heuristics offer promise of control dextrous robot hands in a more natural and efficient way. Author

**N88-14859*#** Illinois State Univ., Normal. Dept. of Applied Computer Science.

**A REVIEW OF HYPERTEXT IN A NASA PROJECT MANAGEMENT CONTEXT Final Report** **c82**

Christopher J. Bell *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 12 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 12 p (SEE N88-14855 06-85)

Avail: NTIS HC A15/MF A01 CSCL 05B

The principles of data storage, the comparative strengths of data bases, and the evolution of hypertext within this context are discussed. A classification schema of indexing and of hypertext document structures is provided. Issues associated with hypertext implementation are also discussed and potential areas for further research are indicated. Author

**N88-14860*#** Louisiana Tech Univ., Ruston. Dept. of Electrical Engineering.

**MATHEMATICAL MODEL FOR THE dc-ac INVERTER FOR THE SPACE SHUTTLE Final Report** **c33**

Frederick C. Berry *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 20 p (SEE N88-14855 06-85)

Avail: NTIS HC A15/MF A01 CSCL 09C

The reader is informed of what was done for the mathematical modeling of the dc-ac inverter for the Space Shuttle. The mathematical modeling of the dc-ac inverter is an essential element in the modeling of the electrical power distribution system of the Space Shuttle. The electrical power distribution system which is present on the Space Shuttle is made up to 3 strings each having a fuel cell which provides dc to those systems which require dc, and the inverters which convert the dc to ac for those elements which require ac. The inverters are units which are 2 wire structures for the main dc inputs and 2 wire structures for the ac output. When 3 are connected together a 4 wire wye connection results on the ac side. The method of modeling is performed by using a Least Squares curve fitting method. A computer program is presented for implementation of the model along with graphs and tables to demonstrate the accuracy of the model. Author

**N88-14861*#** Houston Univ., Tex. Programs in the Natural Sciences.

**ANALYSIS OF LASER EXTRACTED VOLATILES IN CARBONACEOUS CHONDRITES Final Report** **c90**

George E. Blanford *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 14 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 14 p (SEE N88-14855 06-85)

Avail: NTIS HC A15/MF A01 CSCL 03B

It is scientifically important to understand the composition of volatile compounds from interplanetary dust particles (IDPs) because they may be related to the primordial inventory of planetary materials which were necessary to provide environments conducive to the formation of life. The use of a laser microprobe to measure volatiles in IDPs was evaluated. Because primitive meteorites are thought to be closely related to IDPs, carbonaceous chondrites were used for the evaluation. Three sets of experiments were performed to determine the volatiles released from potential substrate materials, to analyze the volatiles released from matrices of bulk samples of carbonaceous chondrites, and to analyze volatiles released from approx. 100 to 200 micron meteorite particles to simulate IDPs. Aluminum appeared to be the best choice of substrate material. Mass ratios between carbonaceous chondrite matrices of Allende and Murchison show fair reproducibility with somewhat high uncertainties. Particles from the Orgueil, Murchison, and Allende meteorites produced measurable quantities of volatiles that appear to have mass spectra comparable to the bulk matrices. Author

**N88-14862*#** University of Southern Illinois, Carbondale. Dept. of Electrical Engineering.

**DIGITAL SIGNAL PROCESSING ALGORITHMS FOR AUTOMATIC VOICE RECOGNITION Final Report** **c32**

Nazeih M. Botros *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 20 p (SEE N88-14855 06-85)

Avail: NTIS HC A15/MF A01 CSCL 17B

The current digital signal analysis algorithms are investigated that are implemented in automatic voice recognition algorithms. Automatic voice recognition means, the capability of a computer to recognize and interact with verbal commands. The digital signal

is focused on, rather than the linguistic, analysis of speech signal. Several digital signal processing algorithms are available for voice recognition. Some of these algorithms are: Linear Predictive Coding (LPC), Short-time Fourier Analysis, and Cepstrum Analysis. Among these algorithms, the LPC is the most widely used. This algorithm has short execution time and do not require large memory storage. However, it has several limitations due to the assumptions used to develop it. The other 2 algorithms are frequency domain algorithms with not many assumptions, but they are not widely implemented or investigated. However, with the recent advances in the digital technology, namely signal processors, these 2 frequency domain algorithms may be investigated in order to implement them in voice recognition. This research is concerned with real time, microprocessor based recognition algorithms.
Author

**N88-14863*#** Prairie View Agricultural and Mechanical Coll., Tex. Dept. of Mechanical Engineering.
**SHUTTLE COMPUTATIONAL GRID GENERATION Final Report c64**
Chang Ing *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 19 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 19 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 12A

The well known Karman-Trefftz conformal transformation, consisting of repeated applications of the same basic formula, were found to be quite successful to body, wing, and wing-body cross sections. This grid generation technique is extended to cross sections of more complex forms, and also more automatic. Computer programs were written for the selection of hinge points on cross section with angular shapes, the Karman-Trefftz tranformation of arbitrary shapes, and the special transform of hinge point on the imaginary axis. A feasibility study is performed for the future application of conformal mapping grid generation to complex three dimensional configurations. Examples such as Orbiter vehicle section and a few others were used. Author

**N88-14864*#** Auburn Univ., Ala. Dept. of Chemistry.
**DEVELOPMENT OF A GRAPHICAL DISPLAY ON THE DMS TEST BED Final Report c62**
Robert A. Donnelly *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 9 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 9 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 09B

The DMS test bed is a model of a data network aboard space station. Users of the network share data relevant to the functional status of various systems aboard the station. Users may inquire the status of myriad sensors, obtaining reading of station subsystem status in real time via the Data Acquisition and Distribution Service. A graphical display of the status of a simulation of the Environmental Control and Life Support System was developed. Two broad issues were addressed: (1) flexible, extensible software design; and (2) the impact of utilizing standard processors, languages, and graphics packages implementing the software design concept. The experience gained with DEC hardware, the DEC implementation of the GKS graphics standard, and with Ada is summarized. Author

**N88-14865*#** State Univ. of New York, Plattsburgh. Dept. of Physics.
**ATMOSPHERIC ENTRY HEATING OF COSMIC DUST Final Report c90**
George J. Flynn *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 20 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 03B

A computer simulation of the atmospheric entry deceleration and heating for micrometeorites into a planetary atmosphere was developed. The results of this model were compared to an earlier model. The major difference between the extent of heating experienced in the two models results from an underestimation of the atmospheric density at altitudes above 130 km in the earlier model. Thus the earlier model systematically overestimates the peak temperature reached on atmospheric entry. The discrepancies are small for near vertical entry and/or high density particles, where little deceleration is experienced at high altitudes. For particles entering at grazing incidence and/or of low density the discrepancies are more pronounced. Gravitational enhancement, which is a function of geocentric velocity at the collection opportunity, was found to bias near Earth cosmic dust collections in favor of low velocity particles. The effect is to increase the proportion of low velocity dust, predominately from asteroids, in the stratospheric cosmic dust collections and on Earth orbiting spacecraft impact surfaces over its proportion in the interplanetary dust cloud. Author

**N88-14866*#** Texas A&M Univ., College Station. Dept. of Mechanical Engineering.
**ACTIVE CONTROL OF FLEXURAL VIBRATIONS IN BEAMS Final Report c39**
Carl H. Gerhold *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 20 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 20K

The feasibility of using piezoelectric actuators to control the flexural oscillations of large structures in space is investigated. Flexural oscillations are excited by impulsive loads. The vibratory response can degrade the pointing accuracy of cameras and antennae, and can cause high stresses at structural node points. Piezoelectric actuators have the advantage of exerting localized bending moments. In this way, vibration is controlled without exciting rigid body modes. The actuators are used in collocated sensor/driver pairs to form a feedback control system. The sensor produces a voltage that is proportional to the dynamic stress at the sensor location, and the driver produces a force that is proportional to the voltage applied to it. The analog control system amplifies and phase shifts the sensor signal to produce the voltage signal that is applied to the driver. The feedback control is demonstrated to increase the first mode damping in a cantilever beam by up to 100 percent, depending on the amplifier gain. The damping efficiency of the control system when the piezoelectrics are not optimally positioned at points of high stress in the beam is evaluated. Author

**N88-14867*#** Pennsylvania State Univ., University Park. Dept. of Industrial Engineering.
**PREDICTION OF PHYSICAL WORKLOAD IN REDUCED GRAVITY ENVIRONMENTS Final Report c54**
Joseph H. Goldberg *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 20 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 05H

The background, development, and application of a methodology to predict human energy expenditure and physical workload in low gravity environments, such as a Lunar or Martian base, is described. Based on a validated model to predict energy expenditures in Earth-based industrial jobs, the model relies on an elemental analysis of the proposed job. Because the job itself need not physically exist, many alternative job designs may be compared in their physical workload. The feasibility of using the model for prediction of low gravity work was evaluated by lowering

body and load weights, while maintaining basal energy expenditure. Comparison of model results was made both with simulated low gravity energy expenditure studies and with reported Apollo 14 Lunar EVA expenditure. Prediction accuracy was very good for walking and for cart pulling on slopes less than 15 deg, but the model underpredicted the most difficult work conditions. This model was applied to example core sampling and facility construction jobs, as presently conceptualized for a Lunar or Martian base. Resultant energy expenditures and suggested work-rest cycles were well within the range of moderate work difficulty. Future model development requirements were also discussed. Author

**N88-14868*#** Galveston Coll., Tex. Div. of Mathematics and Science.
**A SOLID PHASE ENZYME-LINKED IMMUNOSORBENT ASSAY FOR THE ANTIGENIC DETECTION OF LEGIONELLA PNEUMOPHILA (SEROGROUP 1): A COMPLIMENT FOR THE SPACE STATION DIAGNOSTIC CAPABILITY** **c51**
Kelly E. Hejtmancik *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 20 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 06B

It is necessary that an adequate microbiology capability be provided as part of the Health Maintenance Facility (HMF) to support expected microbial disease events and environmental monitoring during long periods of space flight. The application of morphological and biochemical studies to confirm the presence of certain bacterial and fungal disease agents are currently available and under consideration. This confirmation would be facilitated through employment of serological methods to aid in the identification of bacterial, fungal, and viral agents. A number of serological approaches are currently being considered, including the use of Enzyme Linked Immunosorbent Assay (ELISA) technology, which could be utilized during microgravity conditions. A solid phase, membrane supported ELISA for the detection of Legionella pneumophila, an expected disease agent, was developed to show a potential model system that would meet the HMF requirements and specifications for the future space station. These studies demonstrate the capability of membrane supported ELISA systems for identification of expected microbial disease agents as part of the HMF. Author

**N88-14869*#** Texas A&M Univ., Galveston. Dept. of Marine Science.
**POWER AND CHARGE DISSIPATION FROM AN ELECTRODYNAMIC TETHER Final Report** **c33**
Gerald E. Hite *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 20 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 09C

The Plasma Motor-Generator project utilizes the influence of the geomagnetic field on a conductive tether attached to a LEO spacecraft to provide a reversible conversion of orbital energy into electrical energy. The behavior of the current into the ionospheric plasma under the influence of the geomagnetic field is of significant experimental and theoretical interest. Theoretical calculations are reviewed which start from Maxwell's equations and treat the ionospheric plasma as a linear dielectric medium. These calculations show a charge emitting tether moving in a magnetic field will generate electromagnetic waves in the plasma which carry the charge in the direction of the magnetic field. The ratio of the tether's speed to the ion cyclotron frequency which is about 25 m for a LEO is a characteristic length for the phenomena. Whereas for the dimensions of the contact plasma much larger than this value the waves are the conventional Alfven waves, when the dimensions are comparable or smaller, diffraction effects occur similar to those associated with Fresnel diffraction in optics. The power required to excite these waves for a given tether current is used to estimate the impedance associated with this mode of charge dissipation. Author

**N88-14870*#** New Mexico State Univ., Las Cruces. Dept. of Electrical and Computer Engineering.
**HIGH DATA RATE MODEM SIMULATION FOR THE SPACE STATION MULTIPLE-ACCESS COMMUNICATIONS SYSTEM Final Report** **c32**
Stephen Horan *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 19 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 19 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 17B

The communications system for the space station will require a space based multiple access component to provide communications between the space based program elements and the station. A study was undertaken to investigate two of the concerns of this multiple access system, namely, the issues related to the frequency spectrum utilization and the possibilities for higher order (than QPSK) modulation schemes for use in possible modulators and demodulators (modems). As a result of the investigation, many key questions about the frequency spectrum utilization were raised. At this point, frequency spectrum utilization is seen as an area requiring further work. Simulations were conducted using a computer aided communications system design package to provide a straw man modem structure to be used for both QPSK and 8-PSK channels. Author

**N88-14871*#** Houston Univ., Tex. Dept. of Mathematics.
**SOME VISION ALGORITHMS Final Report** **c61**
Gordon G. Johnson *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 16 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 16 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 09B

The ability to determine the contents of a scene by a machine has obvious applications. There are reasons for seeking horizontal, vertical and diagonal line segments of varying lengths in order to interpret the content of a scene. Such line segments aid in determining edges that determine the boundaries of objects within the scene. Algorithms for each of the above as well as for data compacting are presented. Author

**N88-14872*#** Michigan Technological Univ., Houghton. Dept. of Mechanical Engineering/Engineering Mechanics.
**DYNAMICS FORMULATIONS FOR THE REAL-TIME SIMULATION OF CONSTRAINED MOTION Final Report** **c70**
Frederick A. Kelly *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 20 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 20C

The Space Shuttle program has relied heavily on simulation throughout all phases of development and operation. Real-time, man-in-the-loop simulation has served the NASA manned space flight program by providing the means to evaluate systems design and integrated systems performance in a simulated flight environment as well as provide a means to train flight crews. New challenges are presented by the development and operation of a permanently manned space station. The assembly of the space station, the transferral of payloads and the use of the space station manipulator to berth the Orbiter are operations critical to the success of the space station. All these operations are examples of constrained motion among the bodies associated with the Orbiter and space station system. The state of the art of formulating the governing dynamical equations of motion for constrained systems

are described. The uses of the two basic problems in multibody dynamics are discussed. The most efficient formulations of the equations of motion are addressed from the point of view of completeness. The issues surrounding incorporating the constraints into the equation of motion are presented. Author

**N88-14873*#** Washington Univ., Seattle. Dept. of Mechanical Engineering.

**INVENTORY BEHAVIOR AT REMOTE SITES Final Report c66**

William C. Lewis, Jr. *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 24 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 24 p (SEE N88-14855 06-85)

Avail: NTIS HC A15/MF A01 CSCL 12B

An operations research study was conducted concerning inventory behavior on the space station. Historical data from the Space Shuttle was used. The results demonstrated a high logistics burden if Space Shuttle reliability technology were to be applied without modification to space station design (which it was not). Effects of rapid resupply and on board repair capabilities on inventory behavior were investigated. Author

**N88-14874*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)/AMERICAN SOCIETY FOR ENGINEERING EDUCATION (ASEE) SUMMER FACULTY FELLOWSHIP PROGRAM, 1987. VOLUME 2 Final Reports**

William B. Jones, Jr., ed. (Texas A&M Univ., College Station.) and Stanley H. Goldstein, ed. Nov. 1987 332 p Program held in Houston, Texas, 1987; sponsored by NASA, Johnson Space Center, Houston and Texas A/M Univ., College Station

(Grant NGT-44-001-800)

(NASA-CR-172009-Vol-2; NAS 1.26:172009-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 05A

The 1987 Johnson Space Center (JCS) National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship program was conducted by Texas A and M University and JSC. The 10-week program was operated under the auspices of ASEE. The basic objectives of the program are: to further the professional knowledge of qualified engineering and science faculty members; to stimulate an exchange of ideas between participants and NASA; to enrich and refresh the research and teaching activities of participants' institutions; and to contribute to the research objective of the NASA Centers. This document is a compilation of the final reports on the research projects done by the faculty fellows during the summer of 1987. For individual titles, see N88-14875 through N88-14891.

**N88-14875*#** Houston Univ., Tex. Dept. of National Sciences.

**A GENERAL ARCHITECTURE FOR INTELLIGENT TRAINING SYSTEMS Final Report c63**

R. Bowen Loftin *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 15 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 15 p (SEE N88-14874 06-85)

Avail: NTIS HC A15/MF A01 CSCL 09B

A preliminary design of a general architecture for autonomous intelligent training systems was developed. The architecture integrates expert system technology with teaching/training methodologies to permit the production of systems suitable for use by NASA, other government agencies, industry, and academia in the training of personnel for the performance of complex, mission-critical tasks. The proposed architecture consists of five elements: a user interface, a domain expert, a training session manager, a trainee model, and a training scenario generator. The design of this architecture was guided and its efficacy tested through the development of a system for use by Mission Control Center Flight Dynamics Officers in training to perform Payload-Assist Module Deploys from the orbiter. Author

**N88-14876*#** Texas A&I Univ., Kingsville. Dept. of Civil and Mechanical Engineering.

**DYNAMICS, CONTROL AND SENSOR ISSUES PERTINENT TO ROBOTIC HANDS FOR THE EVA RETRIEVER SYSTEM Final Report c37**

Robert A. McLauchlan *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 20 p (SEE N88-14874 06-85)

Avail: NTIS HC A15/MF A01 CSCL 13I

Basic dynamics, sensor, control, and related artificial intelligence issues pertinent to smart robotic hands for the Extra Vehicular Activity (EVA) Retriever system are summarized and discussed. These smart hands are to be used as end effectors on arms attached to manned maneuvering units (MMU). The Retriever robotic systems comprised of MMU, arm and smart hands, are being developed to aid crewmen in the performance of routine EVA tasks including tool and object retrieval. The ultimate goal is to enhance the effectiveness of EVA crewmen. Author

**N88-14877*#** Texas Southern Univ., Houston. Dept. of Computing and Applied Sciences.

**SPECTROSCOPIC INVESTIGATIONS AND MEASUREMENTS OF CERTAIN ARC JET PARAMETERS Final Report c14**

Vedula S. Murty *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 18 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 18 p (SEE N88-14874 06-85)

Avail: NTIS HC A15/MF A01 CSCL 14B

The NASA/JSC Atmospheric Reentry Materials and Structures Evaluation Facility (ARMSEF) was intensively and extensively involved in ground testing of spacecraft materials and thermal protection systems (TPS) in simulated reentry conditions. Ground experiments on surface catalytic efficiency of such TPS requires a knowledge of the flow system in the arc jet. In the work described, spectroscopic diagnostic techniques are used to determine the free stream constituents. Specifically, the emission spectrum of the free stream constituents was obtained and the species therein identified. A laser system was added on, which will give the added capacity of studying the arc jet flow using Laser Raman Spectroscopy (LRS). The LRS technique will complement information obtained from the emission spectra. A short list of further work that can be done in the area of spectroscopic investigations on the arc jet is mentioned. Author

**N88-14878*#** Sul Ross State Univ., Alpine, Tex. Dept. of Geology.

**PETROGENESIS OF BASALTS FROM THE ARCHEAN MATACHEWAN DIKE SWARM SUPERIOR PROVINCE OF CANADA Final Report c46**

Dennis O. Nelson *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 20 p (SEE N88-14874 06-85)

Avail: NTIS HC A15/MF A01 CSCL 08G

The Matachewan Dike swarm of eastern Ontario comprises Archean age basalts that were emplaced in the greenstone, granite-greenstone, and metasedimentary terrains of the Superior Province of Canada. The basalts are Fe-rich tholeiites, characterized by the near ubiquitos presence of large, compositionally uniform, calcic plagioclase. Major and trace element whole-rock compositions, along with microprobe analyses of constituent phases, from a group of dikes from the eastern portion of the province, were evaluated to constrain petrological processes

that operated during the formation and evolution of the magmas. Three compositional groupings, were identified within the dikes. One group has compositional characteristics similar to modern abyssal tholeiites and is termed morb-type. A second group, enriched in incompatible elements and light-REE enriched, is referred to as the enriched group. The third more populated group has intermediate characteristics and is termed the main group. The observation of both morb-type and enriched compositions within a single dike strongly argues for the contemporaneous existence of magmas derived through different processes. Mixing calculations suggest that two possibilities exist. The least evolved basalts lie on a mixing line between the morb-type and enriched group, suggesting mixing of magmas derived from heterogeneous mantle. Mixing of magmas derived from a depleted mantle with heterogeneous Archean crust can duplicate certain aspects of the Matachewan dike composition array. Author

**N88-14879*#** Sul Ross State Univ., Alpine, Tex. Analytical Lab.
**MID-TERTIARY VOLCANO-TECTONIC DEVELOPMENT OF THE SOUTHWESTERN CORDILLERA OF NORTH AMERICA Final Report** **c46**
Kerri L. Nelson *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 19 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 19 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 08G

In the Southwestern Cordillera (SC) of North America, volcanic style changed from dominantly calcalkaline stratovolcanoes to caldera-related magmatism during the mid-Tertiary. The dominant tectonic process affecting the region during this time was convergence of the Farallon and North American Plates. The change in style of volcanism indicates a change in the operative stress regime: compressional for the earlier calcalkaline volcanism and tensional for development of the calderas. The development of the centers were compared to evaluate the volcano-tectonic relationship of caldera development within and between centers and determine the relationships between the earlier calcalkaline and later caldera-style volcanisms. The calderas exhibit three distinct stages of development that are closely associated with the East Pacific Rise/trench collision. The spatial and temporal association of the calcalkaline and caldera-related volcanism argues for the SC representing a region of continued arc magnetism in which the style of volcanism varied in response to differences in regional stresses. Author

**N88-14880*#** Puerto Rico Univ., Mayaguez. Dept. of Electrical and Computer Engineering.
**FAULT-TOLERANT COMPUTER ARCHITECTURE BASED ON INMOS TRANSPUTER PROCESSOR Final Report** **c60**
Jorge L. Ortiz *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 15 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 15 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 09B

Redundant processing was used for several years in mission flight systems. In these systems, more than one processor performs the same task at the same time but only one processor is actually in real use. A fault-tolerance computer architecture based on the features provided by INMOS Transputers is presented. The Transputer architecture provides several communication links that allow data and command communication with other Transputers without the use of a bus. Additionally the Transputer allows the use of parallel processing to increase the system speed considerably. The processor architecture consists of three processors working in parallel keeping all the processors at the same operational level but only one processor is in real control of the process. The design allows each Transputer to perform a test to the other two Transputers and report the operating condition of the neighboring processors. A graphic display was developed to facilitate the identification of any problem by the user. Author

**N88-14881*#** Arizona Univ., Tucson. Dept. of Aerospace and Mechanical Engineering.
**RANDOM LOADING FATIGUE CRACK GROWTH: CRACK CLOSURE CONSIDERATIONS Final Report** **c39**
Keith Ortiz *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 21 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 21 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 20K

The prediction of fatigue crack growth is an important element of effective fracture control for metallic structures and mechanical components, especially in the aerospace industry. The prediction techniques available and applied today are mostly based on fatigue crack growth measurements determined in constant amplitude testing. However, while many service loadings are constant amplitude, many more loadings are random amplitude. An investigation to determine which statistics of random loadings are relevant to fatigue crack closure was conducted. The fundamentals of random processes and crack closure are briefly reviewed, then the relevance of certain random process parameters to the crack closure calculation are discussed qualitatively. A course for further research is outlined. Author

**N88-14882*#** Houston Univ., Tex. Dept. of Industrial Engineering.
**TOOLS AND TECHNOLOGIES FOR EXPERT SYSTEMS: A HUMAN FACTORS PERSPECTIVE Final Report** **c54**
Navaratna S. Rajaram *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 18 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 18 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 05H

It is widely recognized that technologies based on artificial intelligence (AI), especially expert systems, can make significant contributions to the productivity and effectiveness of operations of information and knowledge intensive organizations such as NASA. At the same time, these being relatively new technologies, there is the problem of transfering technology to key personnel of such organizations. The problems of examining the potential of expert systems and of technology transfer is addressed in the context of human factors applications. One of the topics of interest was the investigation of the potential use of expert system building tools, particularly NEXPERT as a technology transfer medium. Two basic conclusions were reached in this regard. First, NEXPERT is an excellent tool for rapid prototyping of experimental expert systems, but not ideal as a delivery vehicle. Therefore, it is not a substitute for general purpose system implementation languages such a LISP or C. This assertion probably holds for nearly all such tools on the market today. Second, an effective technology transfer mechanism is to formulate and implement expert systems for problems which members of the organization in question can relate to. For this purpose, the LIghting EnGineering Expert (LIEGE) was implemented using NEXPERT as the tool for technology transfer and to illustrate the value of expert systems to the activities of the Man-System Division. Author

**N88-14883*#** Southern Univ., Baton Rouge, La. Coll. of Engineering.
**AUTOMATIC ANTENNA SWITCHING DESIGN FOR EXTRA VEHICULAR ACTIVITY (EVA) COMMUNICATION SYSTEM Final Report** **c32**
Manjit S. Randhawa *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 20 p (SEE N88-14874

06-85)
Avail: NTIS HC A15/MF A01 CSCL 17B

An Extra Vehicular Activity (EVA) crewmember had two-way communications with the space station in the Ku-band frequency (12 to 18 GHz). The maximum range of the EVA communications link with the space station is approximately one kilometer for nominal values for transmitter power, antenna gains, and receiver noise figure. The EVA Communications System, that will continue to function regardless of the astronaut's position and orientation, requires an antenna system that has full spherical coverage. Three or more antennas that can be flush mounted on the astronaut's space suit (EMU) and/or his propulsive backpack (MMU), will be needed to provide the desired coverage. As the astronaut moves in the space station, the signal received by a given EVA antenna changes. An automatic antenna switching system is needed that will switch the communication system to the antenna with the largest signal strength. A design for automatic antenna switching is presented and discussed. Author

**N88-14884*#** Houston Univ., Tex. Dept. of Industrial Engineering.
**SPACE STATION SOFTWARE RELIABILITY ANALYSIS BASED ON FAILURES OBSERVED DURING TESTING AT THE MULTISYSTEM INTEGRATION FACILITY Final Report c61**
Tak Chai Tamayo *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 20 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 09B

Quality of software not only is vital to the successful operation of the space station, it is also an important factor in establishing testing requirements, time needed for software verification and integration as well as launching schedules for the space station. Defense of management decisions can be greatly strengthened by combining engineering judgments with statistical analysis. Unlike hardware, software has the characteristics of no wearout and costly redundancies, thus making traditional statistical analysis not suitable in evaluating reliability of software. A statistical model was developed to provide a representation of the number as well as types of failures occur during software testing and verification. From this model, quantitative measure of software reliability based on failure history during testing are derived. Criteria to terminate testing based on reliability objectives and methods to estimate the expected number of fixings required are also presented.
Author

**N88-14885*#** Alabama A & M Univ., Normal. Dept. of Physics.
**ANALYSIS AND INTERPRETATION OF SATELLITE FRAGMENTATION DATA Final Report c18**
Arjun Tan *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 20 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 22B

The velocity perturbations of the fragments of a satellite can shed valuable information regarding the nature and intensity of the fragmentation. A feasibility study on calculating the velocity perturbations from existing equations was carried out by analyzing 23 major documented fragmentation events. It was found that whereas the calculated values of the radial components of the velocity change were often unusually high, those in the two other orthogonal directions were mostly reasonable. Since the uncertainties in the radial component necessarily translate into uncertainties in the total velocity change, it is suggested that alternative expressions for the radial component of velocity be sought for the purpose of determining the cause of the fragmentation from the total velocity change. The calculated variances in the velocity perturbations in the two directions orthogonal to the radial vector indicate that they have the smallest values for collision induced breakups and the largest values for low-intensity explosion induced breakups. The corresponding variances for high-intensity explosion induced breakups generally have values intermediate between those of the two extreme categories. A three-dimensional plot of the variances in the two orthogonal velocity perturbations and the plane change angle shows a clear separation between the three major types of breakups. This information is used to reclassify a number of satellite fragmentation events of unknown category. Author

**N88-14886*#** Prairie View Agricultural and Mechanical Coll., Tex. Dept. of Electrical Engineering.
**TIME-DOMAIN ROBOTIC VISION APPLICATION Final Report c74**
C. L. Tolliver *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 22 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 22 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 20F

The quest for the highest resolution microwaves imaging and the principle of time-domain imaging is the primary motivation for recent developments in time-domain techniques. With the present technology fast time varying signals can now be measured and recorded both in magnitude and in phase. It has also enhanced the ability to extract relevant details concerning the scattering object. In the past, the inference of object geometry or shape from scattered signals has received substantial attention in radar technology. Various inverse scattering theories were proposed to develop analytical solutions to this problem. Furthermore, the random inversion, frequenty swept holography, and the synthetic radar imaging, all of which have two things in common: the physical optic far-field approximation and the utilization of the channels as an extra physical dimension, were also advanced significantly. Despite the inherent vectorial nature of electromagnetic waves, these scalar treatments have brought forth some promising results in practice with notable examples in subsurface and structure sounding. The use of time-domain imaging for space robotic vision applications was proposed. A multisensor approach to vision was shown to have several advantages over the video-only approach.
Author

**N88-14887*#** Prairie View Agricultural and Mechanical Coll., Tex. Honors Coll.
**A STUDY OF THE MINORITY COLLEGE PROGRAMS AT THE NASA JOHNSON SPACE CENTER Final Report c80**
Mfanya Donald Tryman *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 20 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 05K

Research programs in science and engineering at predominantly black and white universities which assist in training and furthering the capabilities of minorities in the field, are examined. The Minority Graduate Researcher's Program and the Historically Black College and University Program were the focus of this research. The objectives included investigating the organizational structure and processes of the programs, how they are run, how they differ, defining particular administrative tasks for these programs, the collection of data related to these programs, and recommending ways in which these programs can be improved for greater efficiency and effectiveness through the Equal Opportunity Programs Office. Author

**N88-14888*#** Michigan State Univ., East Lansing. Dept. of Geological Sciences.
**THE DISTRIBUTION OF EVAPORITIC WEATHERING PRODUCTS ON ANTARCTIC METEORITES Final Report c90**
Michael A. Velbel *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education

(ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 20 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 03B

White evaporite deposits of terrestrial origin occur on some 5 percent of Antarctic meteorites. The few previous studies, and new mineralogical analyses, indicate that the deposits are predominately carbonates and/or sulfates of magnesium. The distribution of white evaporitic salt deposits differs among different meteorite compositional groups and weathering categories. Salts occur with unusual frequency on carbonaceous chondrites, and are especially common in carbonaceous chondrites of weathering categories A and B. Among achondrites, weathering categories A and A/B show the most examples of salt weathering. Unlike carbonaceous chondrites and achrondites, most salt-bearing ordinary (H and L) chondrites are from rustier meteorites of weathering categories B, and to a lesser degree, B/C and C. The LL chondrites are conspicuous by their complete lack or any salt-weathering product. Almost two-thirds of all evaporite-bearing meteorites belong to weathering categories, A, A/B, and B. Where chemical and/or mineralogical data are available, there is a persistent suggestion that evaporite formation is accompanied by elemental redistribution from meteorite interiors. Meteorites of weathering categories B, A/B, and even A may have experienced significant element redistribution and/or contamination as a result of terrestrial exposure. Author

**N88-14889*#** New York Univ., New York. Dept. of Applied Science.
**MODELING THE GROWTH DYNAMICS OF FOUR CANDIDATE CROPS FOR CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEMS (CELSS) Final Report** **c54**
Tyler Volk *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 17 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 17 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 06H

The production of food for human life support for advanced space missions will require the management of many different crops. The research to design these food production capabilities along with the waste management to recycle human metabolic wastes and inedible plant components are parts of Controlled Ecological Life Support Systems (CELSS). Since complete operating CELSS were not yet built, a useful adjunct to the research developing the various pieces of a CELSS are system simulation models that can examine what is currently known about the possible assembly of subsystems into a full CELSS. The growth dynamics of four crops (wheat, soybeans, potatoes, and lettuce) are examined for their general similarities and differences within the context of their important effects upon the dynamics of the gases, liquids, and solids in the CELSS. Data for the four crops currently under active research in the CELSS program using high-production hydroponics are presented. Two differential equations are developed and applied to the general characteristics of each crop growth pattern. Model parameters are determined by closely approximating each crop's data. Author

**N88-14890*#** Northeastern Univ., Boston, Mass. Dept. of Chemical Engineering.
**RAMAN SPECTRA OF ADSORBED LAYERS ON SPACE SHUTTLE AND AOTV THERMAL PROTECTION SYSTEM SURFACE Final Report** **c16**
Ronald J. Willey *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 22 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 22 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 22B

Surfaces of interest to space vehicle heat shield design were struck by a 2 W argon ion laser line while subjected to supersonic arc jet flow conditions. Emission spectra were taken at 90 deg to the angle of laser incidence on the test object. Results showed possible weak Raman shifts which could not be directly tied to any particular parameter such as surface temperature or gas composition. The investigation must be considered exploratory in terms of findings. Many undesirable effects were found and corrected as the project progressed. For instance, initial spectra settings led to ghosts which were eliminated by closing the intermediate of filter slit of the Spex from 8 to 3 mm. Further, under certain conditions, plasma lines from the laser were observed. Several materials were also investigated at room temperature for Raman shifts. Results showed Raman shifts for RCC and TEOS coated materials. The HRSI materials showed only weak Raman shifts, however, substantial efforts were made in studying these materials. Baseline materials showed the technique to be sound. The original goal was to find a Raman shift for the High-temperature Reusable Surface Insulation (HRSI) Reaction Cured borosilicate Glass (RCG) coated material and tie the amplitude of this peak to Arc jet conditions. Weak Raman shifts may be present, however, time limitations prevented confirmation. Author

**N88-14891*#** Prairie View Agricultural and Mechanical Coll., Tex. Dept. of Civil Engineering.
**FRACTURE STUDY OF WINDSHIELD GLASS PANES Final Report** **c39**
H. Y. Yeh *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 20 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 20K

The major stresses which cause crack propagation in windshield glass panes are induced by bending moments which result from the pressure differentials across the panes. Hence the stress intensity factors for the finite plate with the semi-elliptical surface flaw and edge crack under the bending moments are examined. The results show that the crack growth will be upperbound if it is computed by using the stress intensity factor for the finite plate with the edge crack subjected to pure bending moments. Furthermore, if the ratio of crack depth to plate thickness, a/t, is within 0.3, the stress intensity factor can be conservatively assumed to be constant at the value of a/t equal to zero. A simplified equation to predict the structural life of glass panes is derived based on constant stress intensity factor. The accuracy of structural life is mainly dependent on how close the empirical parameter, m, can be estimated. Author

**N88-14892#** Technische Hogeschool Twente, Enschede (Netherlands).
**[ACTIVITIES REPORT OF THE TECHNICAL UNIVERSITY OF TWENTE] Annual Report, 1985 [TH TWENTE. JAARVERSLAG 1985]**
1986 50 p In DUTCH
(ETN-88-90620) Avail: NTIS HC A03/MF A01

The education policy and structure, the evolution in the student population, and the research policy and its social impacts are presented for the different departments of the university: management sciences, chemical technology, electrotechnics, computer sciences, technical physics, applied education, applied mathematics, mechanical engineering, and philosophy and social science. ESA

**N88-14893#** Tokyo Univ. (Japan). Dept. of General Systems Studies.
**IMPRESSIONS, OBSERVATIONS AND COMMENTS ON SCIENCE AND TECHNOLOGY IN JAPAN**
R. S. Cutler (National Science Foundation, Washington, D.C.) May 1987 14 p Sponsored by NSF, Washington, D.C.
(PB87-235743) Avail: NTIS HC A03/MF A01 CSCL 05A

The observations of a research scholar in Japan on how Japanese transfer scientific and technical know-how within their country are presented. Science and technology in Japan, the author's research activities in Japan, Japan's physical and economic environment, areas of excellence, research and development planning and funding, the education system, management, manners, and cooperative research are discussed.
Author

**N88-14894*#** National Aeronautics and Space Administration, Washington, D.C.
**RESEARCH AND TECHNOLOGY OBJECTIVES AND PLANS. SUMMARY, FISCAL YEAR 1986**
Jan. 1986 124 p
(NASA-TM-87504; NAS 1.15:87504) Avail: NTIS HC A06/MF A01 CSCL 05A

This publication represents the NASA research and technology program for FY86. It is a compilation of the Summary portions of each of the RTOPs (Research and Technology Objectives and Plans) used for management review and control of research currently in progress throughout NASA. The RTOP summary is designed to facilitate communication and coordination among concerned technical personnel in government, industry, and universities. The first section containing citations and abstracts of the RTOPs is followed by four indexes: Subject, Technical Monitor, Responsible NASA Organization, and RTOP number. Author

# 88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

# 89 ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

**N88-14895** Stanford Univ., Calif.
**CALIBRATION OF THE EGRET GAMMA RAY TELESCOPE WITH A BACK-SCATTERED LASER BEAM Ph.D. Thesis**
John Richard Mattox 1987 152 p
Avail: Univ. Microfilms Order No. DA8720416

One of the three co-aligned gamma ray telescopes to be placed in orbit aboard the Gamma Ray Observer is EGRET, the energetic gamma ray experiment telescope. EGRET will measure celestial gamma rays in the energy range 20 to 24,000 MeV. A full sky survey is expected to resolve approximately 10 extragalactic and approximately 100 galactic point gamma ray sources. Diffuse gamma ray emission will also be examined. A calibration of the telescope to determine efficiency, angular resolution, and energy resolution as a function of gamma ray energy and arrival direction is necessary to analyze the flight data. EGRET received a calibrated ray exposure with a back-scattered laser beam. Modifications were made to operate over the energy range required for calibration. The beam intensity used was approximately 0.3 gamma rays per machine pulse. The response of the NaI(Tl) spectrometer in EGRET was also used for beam intensity monitoring. A large sample of photomultiplier tubes was evaluated for use with the energy spectrometer. Absolute measurements of gain indicate that the scintillation efficiency of NaI(Tl) is at least 17 + or - 2 percent-significantly higher than was previously assumed.
Dissert. Abstr.

**N88-14896** California Inst. of Tech., Pasadena.
**NEUTRON STARS OBSERVATIONS AS ASTROPHYSICAL PROBES Ph.D. Thesis**
Roger William Romani 1987 203 p
Avail: Univ. Microfilms Order No. DA8719698

Several aspects of observations of neutron stars and compact extragalactic radio sources are considered, with particular regard to their use in constraining certain astrophysical phenomena. A theoretical treatment of the pulse arrivel time analysis can be used to quantitatively probe noise processes affecting the pulsar period and the propagation of the radiation. Important constraints on the background of cosmological gravitational radiation can be derived from timing such pulsars. The thermal X-rays emitted from a warm neutron star, either cooling from its initial formation or heated by internal dissipation are considered. Constructing model atmospheres appropriate to such stars with various effective temperatures and elemental abundances, their emergent spectra and bolometric correction were calculated for observation bands of various X-ray satellites. It was concluded that the present limits on neutron star surface flux are even more constraining that those derived assuming that the spectra are blackbody. How this effects models of neutron star interiors, formation, and cooling are examined. The refraction of radio waves from pulsars and other compact sources by interstellar plasma is also studied.
Dissert. Abstr.

**N88-14897#** Heidelberg Univ. (West Germany). Naturwissenschaftlich Mathematischen Gesamtfakultaet.
**CONSISTENT SPHERICAL NONLOCAL THERMAL EQUILIBRIUM (NLTE) MODELS FOR OBJECTS WITH B-STAR-LIKE LUMINOSITIES Ph.D. Thesis [KONSISTENTE SPHAERISCHE NLTE-MODELLE FUER OBJEKTE MIT LEUCHTKRAEFTEN ENTSPRECHEND B-STERNEN]**
Peter Alexander Hoeflich 1986 252 p In GERMAN Sponsored by Deutsches Forschungsgemeinschaft
(ETN-88-90601) Avail: NTIS HC A12/MF A01

A model for objects with envelopes and luminosities like B stars is presented. The model is characterized by spherical symmetry, consistent treatment of envelope and photosphere, NLTE for hydrogen, radiation equilibrium, stationarity, exact radiation transport and density structures. The dependencies of the physical conditions in the envelopes and of the spectra on the model parameters are discussed. The importance of an exact physical treatment for the understanding of the existence of HII regions and for the interpretation of the spectra, is demonstrated. In contrast with classical HII regions, photoionization by Lyman photons plays only a secondary role. The main reasons for the maintenance of the HII region are photoionization by Balmer photons, bound-bound collisions, low escape probability for line photons, and high radiation densities in optically thin continua.
ESA

**N88-14898*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**PERFORMANCE CONSIDERATIONS FOR THE ASTROMETRIC TELESCOPE FACILITY ON THE PHASE 1 SPACE STATION**
Kenji Nishioka, George D. Gatewood (Pittsburgh Univ., Pa.), Alfred C. Macsy, Charles K. Sobeck, and Joel Sperans Dec. 1987 12 p
(NASA-TM-100040; A-88021; NAS 1.15:100040) Avail: NTIS HC A03/MF A01 CSCL 03A

The Astrometric Telescope Facility (ATF) is an optical telescope facility of extreme astrometric precision whose principle scientific purpose is the detection and study of planetary systems about nearby stars. With the recent change in the space station program to two phases, the suitability of initial operations from the phase 1 station need to be evaluated. This paper presents the results of such an evaluation for the Astrometric Telescope Facility.
Author

**N88-14559*#** Academy of Sciences (USSR), Ashkhabad. Inst. of Physical Technology.
**OPTICAL ELECTRONICS FOR METEOR OBSERVATIONS**
R. I. Shafiev, S. Mukhamednazarov, and I. A. Atamas *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 410-415 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP

Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03A

# 90 ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics*.

**N88-14899#** Los Alamos National Lab., N. Mex.
**THE HISTORY AND DEVELOPMENT OF NONLINEAR STELLAR PULSATION CODES**
C. G. Davis 1987 9 p Presented at the Workshop on Multimode Stellar Pulsations, Budapest, Hungary, 1 Sep. 1987
(Contract W-7405-eng-36)
(DE88-001828; LA-UR-87-3452; CONF-8709169-1) Avail: NTIS HC A02/MF A01

This review is limited to the history and development of nonlinear stellar pulsation codes and methods. The narrative includes examples of practical interest in the application of these numerical methods to problems in stellar pulsation such as Cepheid mass discrepancy, the delineation of the RR Lyrae instability strip, and the question of the development of double-mode pulsation as observed in Cepheids, RR Lyrae and other variable stars. DOE

**N88-14900** California Inst. of Tech., Pasadena.
**LOW MASS STARS WITH MASS LOSS AND LOW-LUMINOSITY CARBON STAR FORMATION Ph.D. Thesis**
Arnold Ian Boothroyd 1987 271 p
Avail: Univ. Microfilms Order No. DA8719650

The effects of large carbon enrichments in static stellar envelopes were investigated using Los Alamos opacities and including carbon ionizations. To search for the production of low-mass, low-luminosity carbon stars, detailed stellar evolutionary computations were carried out for a grid of low-mass stars of different metallicities. The stars were evolved from the main sequence through all intermediate stages and through helium shell flashes on the asymptotic giant branch. The effects of the latest nuclear reaction rates, the Los Alamos opacities, Reimers-type wind mass loss, and detailed treatment of convection and semiconvection were investigated. Two low-luminosity carbon stars were achieved, in excellent agreement with observations. Conditions favoring dredge-up include a reasonably large convective mixing length, low metallicity, relatively large envelope mass, and high flash strength. Mass loss was of major importance, tending to oppose dredge-up; the total mass loss amounts inferred from observations suffice to prevent formation of high-mass, high-luminosity carbon stars. Dissert. Abstr.

**N88-14901** California Univ., Los Angeles.
**A SURVEY STUDY OF ENERGY DISTRIBUTION IN COMPONENT STARS OF ALGOL-TYPE BINARY SYSTEMS Ph.D. Thesis**
Jan Joseph Dobias 1987 334 p
Avail: Univ. Microfilms Order No. DA8719941

A study survey of Algol-type binary systems was undertaken in order to investigate radiative flux distributions of their component stars. For hot primaries low-dispersion ultraviolet spectra, made with the International Ultraviolet Explorer (IUD) satellite, are combined at comparable phases with optical spectrophotometric scans, made at Lick Observatory, and then matched with a least-square method to Kurucz model atmospheres. Cooler secondaries are classified by matching their optical flux distributions, observed at totality, to standard stars. Results show that the U Sagittae system consists of a B7.5V-IV star while the secondary is matched by a G4III IV standard. The RW Tauri system consists of a B8V primary, while the secondary is matched by a KOIII standard. The UV spectrum of the primary in RY Geminorum matches that of an AOV standard. The secondary in RY GEM is KOIV. The system of RS Cephei consists of B9.7Ve and G8III-IV stars. The system of RW Persei consists of B9.6e and K2(+ or - 2)IV-III stars. The system of RX Geminorum consists of AOV or AOIII and K2(+ or - 2) stars. Finally, in Beta Lyrae the primary appears to be a B8.5-B9II-Ib object. Dissert. Abstr.

**N88-14902** California Inst. of Tech., Pasadena.
**RELATIVISTIC STELLAR PULSATIONS Ph.D. Thesis**
Lee Samuel Finn 1987 252 p
Avail: Univ. Microfilms Order No. DA8719665

Studies on the topic of relativistic stellar pulsations are discussed. A new formalism for the study of g-modes in neutron stars is developed. This formalism avoids pitfalls associated with previous formalisms when applied to the study of these low-frequency modes. The formalism involves a new choice of perturbation variables, the introduction of an instantaneous gravity approximation to the field outside the star, and an energy principle for determining gravitational radiation damping times. The formalism is used to study g-modes that arise because of chemical inhomogeneities in neutron star crusts. The g-mode frequencies associated with chemical inhomogeneities are found to be much higher than those associated with finite temperature.
Dissert. Abstr.

**N88-14903** Rochester Univ., N. Y.
**HIGH SPATIAL RESOLUTION OBSERVATIONS OF DUST AND GAS IN NGC 7027 AND THE M8 HOURGLASS Ph.D. Thesis**
Charles Evert Woodward 1987 366 p
Avail: Univ. Microfilms Order No. DA8718964

The spatial relationships among the distribution of the ionized gas, continuum dust emission, and the unidentified 3 to 12 micron infrared dust feature emission yield important clues to the identification of candidate grain/molecule materials responsible for feature emissions, and provide observational constraints useful in the evaluation of proposed emission mechanisms. The results are presented of a systematic study of the 3.28 and 3.4 micron dust emission features, two of the unidentified emission bands frequently detected in the 2 to 4 micron band of a variety of astronomical sources, in two energetically and morphologically dissimilar objects: the planetary nebulae NGC 7027 and the M8 Hourglass HII region. Comparison and analysis of the moderate spectral resolution, high spectral resolution infrared images of NGC 7027 in the 3.28 micron dust-emission feature and the Br alpha hydrogen recombination line clearly show that the 3.28 micron emission is spatially more extended than that of the ionized gas. In the M8 Hourglass region, single-detector mapping of the 3.28 micron dust-emission indicates that the feature emission is associated with the boundary layer at the HII region/molecular cloud interface. In addition, infrared imaging of the Hourglass has revealed the presence of at least five previously undiscovered point sources. Dissert. Abstr.

**N88-14904*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**LOW FREQUENCY VLBI IN SPACE USING GAS-CAN SATELLITES: REPORT ON THE MAY 1987 JPL WORKSHOP**
M. J. Mahoney, D. L. Jones, T. B. H. Kuiper, and R. A. Preston 1 Nov. 1987 73 p Workshop held in Pasadena, Calif., 28-29 May 1987
(Contract NAS7-918)
(NASA-CR-182362; JPL-Pub-87-36; NAS 1.26:182362) Avail: NTIS HC A04/MF A01 CSCL 22A

Summarized are the results of a workshop held at JPL on May 28 and 29, 1987, to study the feasibility of using small, very inexpensive spacecraft for a low-frequency radio interferometer array. Many technical aspects of a mission to produce high angular resolution images of the entire sky at frequencies from 2 to 20 MHz were discussed. The workshop conclusion was that such a mission was scientifically valuable and technically practical. A useful array could be based on six or more satellites no larger than those launched from Get-Away-Special canisters. The cost of each satellite could be $1-2M, and the mass less than 90 kg. Many details require further study, but as this report shows, there is good reason to proceed. No fundamental problems have been discovered involving the use of untraditional, very inexpensive spacecraft for this type of mission. Author

**N88-14905*#** Smithsonian Astrophysical Observatory, Cambridge, Mass.
**EXOSAT GUEST OBSERVER PROGRAM. BINARY PARAMETERS OF THE X-RAY PULSAR 4U1626-67 Final Report, 1 Dec. 1986 - 30 Nov. 1987**
Jeffrey E. McClintock Dec. 1987 33 p
(Grant NAG8-615)
(NASA-CR-182374; NAS 1.26:182374) Avail: NTIS HC A03/MF A01 CSCL 03B

The pulsing X-ray source 4U1626-67 is an accreting neutron star in a binary system with a very low mass companion. The source was observed with EXOSAT continuously for 23 hr on 30 to 31 March 1986 UT. These observations allowed the setting of a stringent upper limit on the projected semimajor axis of the orbit of the neutron star of approx. 10 light msec for the 2485-s orbital period found by Middleditch et al., and a limit of approx. 13 light msec for any other plausible orbital period. The corresponding upper limit on the mass function for the 2485-s orbital period is 1.3 x 0.000001 solar mass. It was concluded that if the orbital inclination angle, i, equals 90 deg, then the optical companion star has a mass greater than 0.02 solar mass. However, it was found that a companion star mass greater than 0.06 solar mass is required if gravitational radiation is responsible for driving the mass transfer in this system. Only for i less than 16 deg can a companion star mass this large be accommodated by the limits set on the orbital amplitude. Also presented are results on the flaring activity in 4U1626-67 on time scales of approx. 1000 s, the energy dependent pulse profiles, and the pulse period history over the past decade. Author

**N88-14906#** National Oceanic and Atmospheric Administration, Boulder, Colo. World Data Center A for Solar-Terrestrial Physics.
**SOLAR-GEOPHYSICAL ACTIVITY REPORTS FOR STIP (STUDY OF TRAVELLING INTERPLANETARY PHENOMENA) INTERVAL 15, 12-21 FEBRUARY 1984 GROUND LEVEL EVENT AND STIP INTERVAL 16, 20 APRIL-4 MAY 1984 FORBUSH DECREASE**
Helen E. Coffey, comp. and Joe H. Allen, comp. Jul. 1987 418 p
(PB88-101274; UAG-96) Avail: NTIS HC A18/MF A01 CSCL 03B

This report includes the following: solar-geophysical activity reports for STIP interval XV 12 to 21 February 1984 ground-level event and STIP interval XVI 20 April to 4 May 1984 forbush decrease; and overview of solar terrestrial physics phenomena for STIP interval XV (12 to 21 February 1984) and STIP interval XVI (20 April to 4 May 1984). GRA

**N88-14503*#** Academy of Sciences of the Tajik SSR, Doushanbe. Inst. of Astrophysics.
**DYNAMICS OF METEOR STREAMS**
P. B. Babadjanov and Yu. U. Obrubov *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 2-10 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14504*#** Academy of Sciences (USSR), Ashkhabad. Inst. of Physical Technology.
**ELEMENTARY PROCESS AND METEOR TRAIN SPECTRA**
O. G. Ovezgeldyev *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 11-21 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14507*#** Kyoto Univ., Uji (Japan). Radio Atmospheric Science Center.
**METEOR OBSERVATION BY THE KYOTO METEOR RADAR**
Susumu Kato and Toshitaka Tsuda *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 45-49 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14533*#** Academy of Sciences (USSR), Ashkhabad. Inst. of Physical Technology.
**ON THE METEOR TRAIL SPECTRA**
O. G. Ovezgeldyev, S. Mukhamednazarov, R. I. Shafiev, and N. V. Maltsev *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 222-227 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14535*#** University of Northern Illinois, De Kalb. Meteorology Program.
**THE END HEIGHT OF FIREBALL AS A FUNCTION OF THEIR RESIDUAL KINETIC ENERGY**
D. O. ReVelle *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 255-257 Sponsored by NASA (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14539*#** Kazan State Univ. (USSR).
**A PROCESSING METHOD AND RESULTS OF METEOR SHOWER RADAR OBSERVATIONS**
O. I. Belkovich, N. I. Suleimanov, and V. S. Tokhtasjev *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 272-279 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14540*#** Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
**PHOTOGRAPHIC FIREBALL NETWORKS**
Z. Ceplecha *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 280-287 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14541*#** Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
**A METHOD OF LONG-TERM RADAR SHOWER DATA ANALYSIS**
M. Simek *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 288-293 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14542*#** Academy of Sciences of the Tajik SSR, Doushanbe.
**INCIDENT METEOROID FLUX DENSITY**
P. B. Badadjanov, R. Sh. Bibarsov, V. S. Getman, and V. M. Kolmakov *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 294-297 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14543*#** Kazan State Univ. (USSR).
**MODELS OF SPORADIC METEOR BODY DISTRIBUTIONS**
V. V. Andreev and O. I. Belkovich *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 298-304 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14544*#** Tomsk State Univ. (USSR).
**ON METEOR STREAM SPATIAL STRUCTURE THEORY**
G. V. Andreev *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 305-310 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14545*#** Tomsk State Univ. (USSR).
**DENSITY VARIATIONS OF METEOR FLUX ALONG THE EARTH'S ORBIT**
N. T. Svetashkova *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 311-315 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14546*#** Moscow Physical-Engineering Inst. (USSR).
**METEOR VELOCITY DISTRIBUTION AND AN OPTIMUM MONITORING MATHEMATICAL MODEL**
N. G. Volkov and O. N. Salimov *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 316-320 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14547*#** Ceskoslovenska Akademie Ved, Ondrejov. Astronomical Inst.
**THE VALEC FIREBALL AND PREDICTED METEORITE FALL**
Z. Ceplecha and P. Spurny *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 321-328 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14548*#** Slovak Academy of Sciences, Bratislava (Czechoslovakia). Astronomical Inst.
**RESULTS OF OBSERVATIONS OF THE ETA AQUARID AND ORIONID METEOR SHOWERS IN 1980-1984**
A. Hajduk *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 329-335 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14549*#** Moscow Physical-Engineering Inst. (USSR).
**MONTE CARLO MODELING AND METEOR SHOWERS**
N. V. Kulikova *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 336-338 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14550*#** Academy of Sciences of the Tajik SSR, Doushanbe.
**ON THE SPATIAL STRUCTURE OF THE PERSEIDS METEOR STREAM**
G. V. Andreev, L. N. Rubtsov, and I. I. Tarasova *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 339-343 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14551*#** Kazan State Univ. (USSR).
**SOME MODELS OF THE GEMINIDS METEOR STREAM FORMATION**
O. I. Belkovich and G. O. Ryabova *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 344-350 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14552*#** Academy of Sciences of the Tajik SSR, Doushanbe.
**STRUCTURAL PECULIARITIES OF THE QUADRANTID METEOR SHOWER**
SH. O. Isamutdinov and R. P. Chebotarev *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 351-355 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14553*#** Kiev State Univ. (USSR).
**ON THE POSSIBLE ORIGIN OF METEOROID GENERATING ASTEROID ORBITS**
A. M. Kazantsev and L. M. Sherbaum *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 356-360 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14554*#** Colorado Univ., Boulder.
**METEOR DETECTION ON ST (MST) RADARS**
S. K. Avery *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 361-375 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14557*#** State Univ. of New York, Geneseo. Dept. of Physics and Astronomy.
**NEW APPROACHES TO SOME METHODOLOGICAL PROBLEMS OF METEOR SCIENCE**
David D. Meisel *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Volume 25 Aug. 1987 p 389-404 (For primary document see N88-14502 06-46)
Avail: NTIS HC A19/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 03B

**N88-14758#** Joint Publications Research Service, Arlington, Va.
**MODEL OF EARLIER STAGE OF UNIVERSE'S EVOLUTION Abstract Only**
K. A. Bronnikov and V. N. Melnikov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 53 Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedeniy: Fizika (Tomsk, USSR), v. 29, no. 11, Nov. 1986 p 54-58 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14759#** Joint Publications Research Service, Arlington, Va.
**EVOLUTION OF PERTURBATIONS IN EXPANDING UNIVERSE Abstract Only**
A. A. Kofman and V. F. Mukhanov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 54 Transl. into ENGLISH from Pisma v Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 44, no. 11, 10 Dec. 1986 p 481-483 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14760#** Joint Publications Research Service, Arlington, Va.
**GRAVITATIONAL INTERACTION OF MASSLESS FIELDS WITH HIGHER SPINS (s GREATER THAN 2) Abstract Only**
M. A. Vasilyev and Ye. S. Fradkin *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 25 Jun. 1987 p 54-55 Transl. into ENGLISH from Pisma v Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 44, no. 11, 10 Dec. 1986 p 484-488 (For primary document see N88-14727 06-70)
Avail: NTIS HC A05/MF A01

**N88-14861*#** Houston Univ., Tex. Programs in the Natural Sciences.
**ANALYSIS OF LASER EXTRACTED VOLATILES IN CARBONACEOUS CHONDRITES Final Report**
George E. Blanford *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 14 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 14 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 03B

**N88-14865*#** State Univ. of New York, Plattsburgh. Dept. of Physics.
**ATMOSPHERIC ENTRY HEATING OF COSMIC DUST Final Report**
George J. Flynn *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 1 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 1 20 p (SEE N88-14855 06-85)
Avail: NTIS HC A15/MF A01 CSCL 03B

**N88-14888*#** Michigan State Univ., East Lansing. Dept. of Geological Sciences.
**THE DISTRIBUTION OF EVAPORITIC WEATHERING PRODUCTS ON ANTARCTIC METEORITES Final Report**
Michael A. Velbel *In* NASA. Lyndon B. Johnson Space Center, Houston, Tex. NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1987. Volume 2 Nov. 1987 20 p (For primary document see Summer Faculty Fellowship Program, 1987. Volume 2 20 p (SEE N88-14874 06-85)
Avail: NTIS HC A15/MF A01 CSCL 03B

# 91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

**N88-14907*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**SPACE STATION ACCOMMODATIONS FOR LUNAR BASE ELEMENTS: A STUDY**
Deene J. Weidman, William Cirillo, Charles Llewellyn, Martin Kaszubowski, and E. Michael Kienlen, Jr. (National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.) Oct. 1987 246 p
(NASA-TM-100501; NAS 1.15:100501) Avail: NTIS HC A11/MF A01 CSCL 22B

The results of a study conducted at NASA-LaRC to assess the impact on the space station of accommodating a Manned Lunar Base are documented. Included in the study are assembly activities for all infrastructure components, resupply and operations support for lunar base elements, crew activity requirements, the effect of lunar activities on Cape Kennedy operations, and the effect on space station science missions. Technology needs to prepare for such missions are also defined. Results of the study indicate that the space station can support the manned lunar base missions with the addition of a Fuel Depot Facility and a heavy lift launch vehicle to support the large launch requirements. Author

**N88-14908*#** Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
**A JUPITER DATA ANALYSIS PROGRAM (JDAP) RESEARCH GRANT ON WAVE ACCESSIBILITY AND ATTRIBUTES Final Report**
Wynne Calvert [1987] 109 p
(Grant NAGw-256)
(NASA-CR-182348; NAS 1.26:182348) Avail: NTIS HC A06/MF A01 CSCL 03B

For more than thirty years the intense decametric radio emissions from Jupiter (DAM) and the corresponding auroral kilometric radiation from the Earth (AKR) have remained major radio science mysteries. Part of the problem, aside from their inherent complexity, has been the difficulty of measuring their source location and emission properties from limited observations. Progress has been made on this problem by locating the source directly, i.e., by analysis of the faraday rotation observed with Voyager as the wave path crossed the Io plasma torus, and indirectly by comparing the peak frequencies of the decametric emission with that at the foot of the Io flux tube. Progress was also made on the general question of how the emissions originate by finding properties of both the AKR and DAM which would imply emission by natural radio lasing. Author

**N88-14909** California Inst. of Tech., Pasadena.
**MARS: HIGH RESOLUTION VLA OBSERVATIONS AT WAVELENGTHS OF 2 AND 6 cm AND DERIVED PROPERTIES Ph.D. Thesis**
Donald James Rudy 1987 156 p
Avail: Univ. Microfilms Order No. DA8719700

Observations of Mars at wavelengths of 2 and 6 cm were made using the Very Large Array (VLA) in its A configuration. Two seasons were observed; late spring in the Northern Hemisphere and early summer in the Southern Hemisphere. Whole-disk brightness temperatures and whole-disk effective dielectric constants were estimated. From mapped data these parameters were also estimated as a function of latitude between latitudes 15 deg S and 60 deg N for the north data set; and between latitudes of 30 deg N and 60 deg S for the south data set. In addition to the effective dielectric constant and subsurface density the radio absorption length of the subsurface was estimated. A region in which the brightness temperature behaves in an anomalous manner was discovered in both data sets. This region

lies between about 10 deg S and 40 deg S. Here the brightness temperature at both wavelengths in both data sets appears lower than a nominal model would predict. In addition, the thermal-radiative model used to estimate the above parameters was used to estimate the variability of the whole-disk brightness temperature of Mars. This was done in an effort to establish a background for astronomers wishing to use Mars as a calibration source. The parameters investigated for their effect on the whole-disk brightness temperature of Mars were: the subearth longitude, the Martian season, the subearth latitude, the subearth time of day, the dielectric constant, and the radio absorption length. Dissert. Abstr.

**N88-14910** California Univ., Los Angeles.
**INTERPLANETARY MAGNETIC FIELD EFFECTS ON THE INTERACTION OF THE SOLAR WIND WITH VENUS Ph.D. Thesis**
John Lynch Phillips 1987 314 p
Avail: Univ. Microfilms Order No. DA8719967

The solar wind interaction with Venus is examined with emphasis on the role of the interplanetary magnetic field (IMF) using observations from Pioneer Venus Orbiter (PVO). Based on a survey of low altitude magnetometer observations, the planetary magnetic moment is less than 8.4 times 10 to the 10th power Tm (3), or roughly 1/100,000 of the terrestrial moment. As a result, the impact of changing IMF orientation on the interaction is very different at Venus than at the magnetized planets. The solar plasma interacts directly with the ionospheric plasma, which generally is able to maintain a shielding current system which constitutes an impenetrable boundary. Dissert. Abstr.

**N88-14604#** Joint Publications Research Service, Arlington, Va.
**PHOTOCHEMICAL CONVERSION OF NUCLEIC ACID COMPONENTS CATALYZED BY LUNAR SOIL Abstract Only**
Ye. A. Kuzicheva *In its* JPRS Report: Science and Technology. USSR: Life Sciences 14 Sep. 1987 p 15 Transl. into ENGLISH from Zhurnal Evolyutionnoy Biokhimii i Fiziologii (Leningrad, USSR), v. 23, no. 1, Jan. - Feb. 1987 p 3-8 (For primary document see N88-14601 06-51)
Copyright Avail: NTIS HC A06/MF A01

# 92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

For related information see *93 Space Radiation.*

**N88-14911*#** Colorado Univ., Boulder. Astrophysical, Planetary, and Atmospheric Sciences.
**SOLAR DYNAMICS AND G-MODES Final Report**
Jane B. Blizard 10 Feb. 1987 32 p
(Contract NAS5-28196)
(NASA-CR-180737; NAS 1.26:180737) Avail: NTIS HC A03/MF A01 CSCL 03B

Various properties of r-modes that would occupy the solar convection zone were computed. Values were calculated for the energy loss from the coefficient of eddy viscosity using the solar convective zone model. Viscous damping is strong and removes one-third or more of the mode energy each oscillation period. A fast Fourier transform (FFT) of daily Zurich sunspot number was made for eight sets of data, taken near peaks of solar cycles 14 to 21. The FFTs were evaluated with the Wolff and Hickey model. The horizontal component of F sub h of the force exerted by a planetary torque was calculated to see is it works on the photospheric layers at a rate comparable to 0.000001 solar luminosity. The time span of torque in the external sector of the Sun was calculated. The duration of the effect of two planets in conjunction on sunspot numbers was examined. The north-south asymmetry of solar activity was investigated. B.G.

**N88-14912#** National Geophysical Data Center, Boulder, Colo.
**SOLAR-GEOPHYSICAL DATA NUMBER 515, JULY 1987. PART 1: (PROMPT REPORTS). DATA FOR JUNE 1987, MAY 1987 AND LATE DATA**
Helen E. Coffey, ed. and J. A. McKinnon, ed. Jul. 1987 123 p
(Contract N00014-86-F-0049)
(PB87-233177; SGD-515-Pt-1; ISSN-0038-0911; LC-79-640375)
Avail: NTIS HC A06/MF A01 CSCL 03B

Solar-geophysical data included are: detailed index for 1986 to 1987; data for June 1987 (advance and worldwide IUWDS alert periods, solar activity indices, solar flares, solar radio emission, and Stanford mean solar magnetic field); data for May 1987 (solar active regions, sudden ionospheric disturbances, solar radio spectral observations, cosmic ray measurements by neutron monitor, and geomagnetic indices, radio propagation indices); and late data (solar active regions-shaded H-alpha synoptic charts October 1986 to February 1987, solar radio emission (solar interferometric chart Nancay May 1987, and Culgoora spectral observations April to November 1986), and geomagnetic indices (sudden commencements March to April 1987, and provisional Dst February to March 1987)). GRA

**N88-14913#** National Geophysical Data Center, Boulder, Colo.
**SOLAR-GEOPHYSICAL DATA NUMBER 515, JULY 1987. PART 2: (COMPREHENSIVE REPORTS). DATA FOR JANUARY 1987 AND MISCELLANEA**
Helen E. Coffey, ed. and J. A. McKinnon, ed. Jul. 1987 34 p
(Contract N00014-86-F-0049)
(PB87-233185; SGD-515-Pt-2; ISSN-0038-0911; LC-79-640375)
Avail: NTIS HC A03/MF A01 CSCL 03B

Solar-geophysical data presented include: detailed index for 1986 to 1987; data for January 1987 (Meudon carte synoptique, solar flares, solar radio bursts at fixed frequencies, solar X-ray radiation from GOES satellite, and active prominences and filaments); and miscellaneous data (solar irradiance updated data, and SMM ACRIM February 1980 to June 1985). GRA

**N88-14914#** National Geophysical Data Center, Boulder, Colo.
**SOLAR-GEOPHYSICAL DATA NUMBER 515, JULY 1987. SUPPLEMENT (EXPLANATION OF DATA REPORTS)**
Helen E. Coffey, ed. and J. A. McKinnon, ed. Jul. 1987 89 p
(Contract N00014-86-F-0049)
(PB87-233169; SGD-515-Suppl; LC-79-640375; ISSN-0038-0911)
Avail: NTIS HC A05/MF A01 CSCL 03B

The supplement contains the description and explanation of the data in the monthly publication Solar-Geophysical Data, compiled by the National Geological Data Center in Boulder, Colorado. Solar-Geophysical Data is intended to keep research workers informed on a timely schedule of the major events of solar activity and the associated interplanetary, ionospheric, radio propagation and other geophysical effects. GRA

**N88-14915#** National Oceanic and Atmospheric Administration, Boulder, Colo. World Data Center A for Solar-Terrestrial Physics.
**SOLAR-GEOPHYSICAL ACTIVITY REPORTS FOR STIP (STUDY OF TRAVELLING INTERPLANETARY PHENOMENA) INTERVAL 15, 12-21 FEBRUARY 1984 GROUND LEVEL EVENT AND STIP INTERVAL 16, 20 APRIL-4 MAY 1984 FORBUSH DECREASE**
Helen E. Coffey, comp. and J. H. Allen, comp. Jul. 1987 417 p
(PB87-232658; UAG-96) Avail: NTIS HC A18/MF A01 CSCL 03B

Included are: overview of solar-terrestrial physics phenomena for Study of Travelling Interplanetary Phenomena (STIP) interval 15 (12 to 21 February 1984) and STIP interval 16 (20 April to 4 May 1984); solar optical reports; solar radio events; spacecraft observations; cosmic ray observations; ionosphere; geomagnetism; a list of reference papers; and an author index. Author

**N88-14916#** Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.
**OBSERVATION AND INTERPRETATION OF SOLAR S-COMPONENT RADIATION AT MILLIMETRE WAVES**

J. Hildebrandt, A. Krueger, S. Urpo, and H. Teraesranta 1987 28 p
(PB87-225207; ISBN-951-754-160-0) Avail: NTIS HC A03/MF A01 CSCL 03B

Methods and results are summarized from a study of single sources of the slowly varying component (S-component) of the solar radio emission at mm-waves. There is included a list of the available data (referring to source positions at heliographic longitudes within + or - 50 deg from the central meridian) derived from solar maps obtained at Metsahovi during the period 1978 to 1984. The measuring frequencies are 11.6, 22.2, 36.8, 77.1, and 80.5 GHz. The observations are interpreted by means of model calculations applying radiative transfer of Coulomb bremsstrahlung and gyromagnetic emission. Examples of those calculations are shown in the form of tables. Accurate agreement between calculations and observation implies the existence of subtelescopic inhomogenous structures of the radiating plasma (according to the presence of sunspots, bright plage elements, and a quasi-quiet background). GRA

**N88-14917#** Science Research Council, Chilton (England).
**FLARES: SOLAR AND STELLAR**
P. M. Gondhalekar May 1986 262 p
(PB87-124962; RAL-86-085) Avail: NTIS HC E11/MF E11 CSCL 03B

This report on solar and stellar flares contains the following: solar-type phenomena in stars - an overview of the solar-stellar connection; the early stages of solar flares; observational aspects of the thermal phase of solar flares; solar-type activity phenomena amongst the dKe-dMe stars; flares in RS CVn stars; flare-like variability on T Tauri stars; the MHD of solar flares - theory; solar flares - thermal phase models; flares - the solar-stellar perspective and opportunities; T Tauri stars - flare characteristics and flare models; and summary and conclusions. GRA

**N88-14918#** Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
**ROME NEUTRON MONITOR (NM) - 64 DATA FOR 5 SOLAR PARTICLE GROUND-LEVEL EVENTS**
N. Iucci, M. Parisi, C. Signorini, M. Storini, G. Villoresi, and N. L. Zangrilli Apr. 1986 29 p
(IFSI-86-7; ETN-88-91280) Avail: NTIS HC A03/MF A01

Data and graphs for 5 solar particle ground-level events in the period 1978-1984 are reported. A clear contribution of solar particles to the Rome cosmic ray intensity is observed during May 7, 1978. ESA

**N88-14919*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**MAX '91: FLARE RESEARCH AT THE NEXT SOLAR MAXIMUM**
Brian Dennis, Richard Canfield, Marilyn Bruner, Gordon Emslie, Ernest Hildner, Hugh Hudson, Gordon Hurford, Robert Lin, Robert Novick, and Ted Tarbell Jan. 1988 42 p Original contains color illustrations
(NASA-TM-89700; NAS 1.15:89700) Avail: NTIS HC A03/MF A01 CSCL 03B

To address the central scientific questions surrounding solar flares, coordinated observations of electromagnetic radiation and energetic particles must be made from spacecraft, balloons, rockets, and ground-based observatories. A program to enhance capabilities in these areas in preparation for the next solar maximum in 1991 is recommended. The major scientific issues are described, and required observations and coordination of observations and analyses are detailed. A program plan and conceptual budgets are provided. J.P.B.

**N88-14920#** Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
**NATURE AND THE NONLINEAR EVOLUTION OF ELECTROSTATIC WAVES ASSOCIATED WITH THE AMPTE (ACTIVE MAGNETOSPHERE PARTICLE TRACER EXPLORERS) SOLAR WIND RELEASES Progress Report**
N. Omidi, K. Akimoto, D. A. Gurnett, and R. R. Anderson Jul. 1987 54 p Prepared in cooperation with California Univ., Los Angeles
(Contract N00014-82-K-0183)
(AD-A185471; IGPP-3042; PPG-1083) Avail: NTIS HC A04/MF A01 CSCL 03B

The nonlinear evolution of the electrostatic waves observed during the AMPTE (Active Magnetosphere Particle Tracer Explorers) solar wind releases is investigated. Previous linear studies indicate two distinct sets of instabilities may be responsible for the generation. One set consists of ion-acoustic type instabilities which are insensitive to the presence of a background magnetic field, while the other group corresponds to the modified two stream instabilities and requires the solar wind flow to be across the ambient magnetic field. To establish which set of instabilities is more viable a detailed linear Vlasov theory has been conducted by numerically solving the full electromagnetic dispersion relation. In addition both the plasma wave as well as the magnetic field measurements by the IRM (Ion Release Module) spacecraft were used to correlate the frequency and the power of the observed waves with the magnitude and the direction of the solar wind magnetic field. The results of these analyses indicate that the ion-acoustic type instabilities have growth rates that are an order of magnitude or more larger than those of the modified two stream instabilities. Results show that both the solar wind protons and the released ions may be heated and accelerated in the directions oblique to the solar wind flow velocity. GRA

# 93 SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

**N88-14921** California Univ., San Diego.
**SPHERICAL MODELS OF QSO/AGN EMISSION LINE CLOUDS Ph.D. Thesis**
Philip Stephen Petersen 1987 167 p
Univ. Microfilms Order No. DA8720184

Theoretical models of Quasi-Stellar Objects (QSO) and Active Galactic Nuclei (AGN) emission lines are presented, assuming spherical cloud geometry. The emission of a single spherical cloud in the presence of a distant ionizing nonthermal continuum with an assumed power law index of -1 is considered. The clouds are modeled as pure hydrogen with 5 levels plus continuum, isothermal, isobaric, utilizing the escape probability approximation. Level populations and angular emission functions for appropriate spectra lines are calculated for a single cloud for varying model parameters. In addition, spherical clouds are compared to slabs. Dynamical requirements are examined. An orbital model is explored in which spherical clouds slowly diffuse in from a virialized cluster under gravity. The model predicts that resolution of this region will yield local profiles with width between narrow and broad lines. In addition, for a given fit to a broad line, the size of the Intermediate Line Region (ILR) is given, and ranges of acceptable central compact mass and number of stars are provided. Dissert. Abstr.

**N88-14922#** Rome Univ. (Italy). Dipt. di Fisica.
**DATA RECORDED BY THE ROME ROOM TEMPERATURE GRAVITATIONAL WAVE ANTENNA, DURING THE SUPERNOVA SN 1987 A IN THE LARGE MAGELLANIC CLOUD**
E. Amaldi, P. Bonifazi, M. G. Castellano, E. Coccia, C. Cosmelli, S. Frasca, M. Gabellieri, I. Modena, G. V. Pallottino, and G. Pizzella et al. 2 Apr. 1987 19 p Presented at Les Rencontres de Physique de la Vallee d'Aoste, La Thuile, France, 1-7 Mar. 1987, and the 22th Rencontres de Moriond on Electroweak Interactions and Unified Theories, Les Arcs, France, 8-15 Mar. 1987
(Nota-Interna-879; ETN-88-91240) Avail: NTIS HC A03/MF A01

A neutrino burst during supernova SN 1987 A was observed with a low sensitivity gravitational wave antenna. While the time correlation with the neutrinos suggests the possibility that the event detected may be due to gravitational radiation emitted by the SN 1987 A, the very high value of the energy that seems to be required for producing it throws very serious doubts on this interpretation. ESA

**N88-14923#** Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.

**A COMPILATION OF SUDDEN STORM COMMENCEMENTS (SSCS), ASSOCIATED INTERPLANETARY DISTURBANCES, AND COSMIC RAY VARIATIONS**

N. Iucci, M. Parisi (Rome Univ., Italy ), M. Storini, and G. Villoresi Nov. 1986 28 p

(IFSI-86-11; ETN-88-91282) Avail: NTIS HC A03/MF A01

Geomagnetic disturbances together with the variations of the interplanetary medium parameters (B, V, N, T), the possible origin of perturbation, and an estimate of the galactic cosmic ray intensity decrease are listed. The period 1966 to 1974 is covered. ESA

## 99 GENERAL

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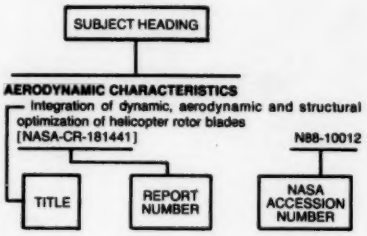


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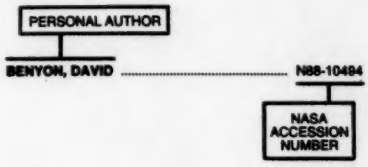


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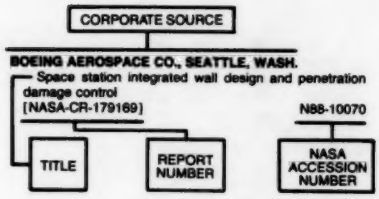


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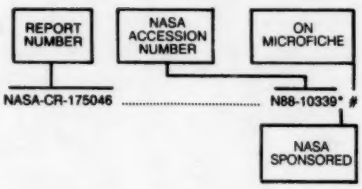


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**UNIV. OF IDAHO LIBRARY**
Documents Section
Moscow, ID 83843
(208) 885-6344

## ILLINOIS

**ILLINOIS STATE LIBRARY**
Information Services Branch
Centennial Building
Springfield, IL 62756
(217) 782-5185

## INDIANA

**INDIANA STATE LIBRARY**
Serials Documents Section
140 North Senate Avenue
Indianapolis, IN 46204
(317) 232-3686

## IOWA

**UNIV. OF IOWA LIBRARIES**
Govt. Documents Department
Iowa City, IA 52242
(319) 353-3318

## KANSAS

**UNIVERSITY OF KANSAS**
Doc. Collect—Spencer Lib.
Lawrence, KS 66045-2800
(913) 864-4662

## KENTUCKY

**UNIV. OF KENTUCKY LIBRARIES**
Govt. Pub. Department
Lexington, KY 40506-0039
(606) 257-3139

## LOUISIANA

**LOUISIANA STATE UNIVERSITY**
Middleton Library
Govt. Docs. Dept.
Baton Rouge, LA 70803
(504) 388-2570

**LOUISIANA TECHNICAL UNIV. LIBRARY**
Documents Department
Ruston, LA 71272-0046
(318) 257-4962

## MAINE

**UNIVERSITY OF MAINE**
Raymond H. Fogler Library
Tri-State Regional Documents Depository
Orono, ME 04469
(207) 581-1680

## MARYLAND

**UNIVERSITY OF MARYLAND**
McKeldin Lib.—Doc. Div.
College Park, MD 20742
(301) 454-3034

## MASSACHUSETTS

**BOSTON PUBLIC LIBRARY**
Government Docs. Dept.
Boston, MA 02117
(617) 536-5400 ext.226

## MICHIGAN

**DETROIT PUBLIC LIBRARY**
Sociology Department
5201 Woodward Avenue
Detroit, MI 48202-4093
(313) 833-1409

**MICHIGAN STATE LIBRARY**
P.O. Box 30007
Lansing, MI 48909
(517) 373-1593

## MINNESOTA

**UNIVERSITY OF MINNESOTA**
Government Pubs. Division
409 Wilson Library
309 19th Avenue South
Minneapolis, MN 55455
(612) 373-7870

## MISSISSIPPI

**UNIV. OF MISSISSIPPI LIB.**
Documents Department
University, MS 38677
(601) 232-5857

## MONTANA

**UNIV. OF MONTANA**
Mansfield Library
Documents Division
Missoula, MT 59812
(406) 243-6700

## NEBRASKA

**UNIVERSITY OF NEBRASKA - LINCOLN**
Love Library
Documents Department
Lincoln, NE 68588-0410
(402) 472-2562

## NEVADA

**UNIVERSITY OF NEVADA LIB.**
Govt. Pub. Department
Reno, NV 89557-0044
(702) 784-6579

## NEW JERSEY

**NEWARK PUBLIC LIBRARY**
5 Washington Street
Newark, NJ 07101-0630
(201) 733-7812

## NEW MEXICO

**UNIVERSITY OF NEW MEXICO**
Zimmerman Library
Government Pub. Dept.
Albuquerque, NM 87131
(505) 277-5441

**NEW MEXICO STATE LIBRARY**
Reference Department
325 Don Gaspar Avenue
Santa Fe, NM 87503
(505) 827-3826

## NEW YORK

**NEW YORK STATE LIBRARY**
Empire State Plaza
Albany, NY 12230
(518) 474-5563

## NORTH CAROLINA

**UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL**
Davis Library
BA/SS Documents Division
Chapel Hill, NC 27515
(919) 962-1151

## NORTH DAKOTA

**UNIVERSITY OF NORTH DAKOTA**
Chester Fritz Library
Documents Department
Grand Forks, ND 58202
(701) 777-4629
In cooperation with North Dakota State Univ. Library

## OHIO

**STATE LIBRARY OF OHIO**
Documents Department
65 South Front Street
Columbus, OH 43266-0334
(614) 462-7051

## OKLAHOMA

**OKLAHOMA DEPT. OF LIB.**
Government Documents
200 NE 18th Street
Oklahoma City, OK 73105
(405) 521-2502, ext. 252

**OKLAHOMA STATE UNIV. LIB.**
Documents Department
Stillwater, OK 74078
(405) 624-6546

## OREGON

**PORTLAND STATE UNIV. LIB.**
Documents Department
P.O. Box 1151
Portland, OR 97207
(503) 229-3673

## PENNSYLVANIA

**STATE LIBRARY OF PENN.**
Government Pub. Section
P.O. Box 1601
Harrisburg, PA 17105
(717) 787-3752

## TEXAS

**TEXAS STATE LIBRARY**
Public Services Department
P.O. Box 12927—Cap. Sta.
Austin, TX 78711
(512) 475-2996

**TEXAS TECH. UNIV. LIBRARY**
Govt. Documents Department
Lubbock, TX 79409
(806) 742-2268

## UTAH

**UTAH STATE UNIVERSITY**
Merrill Library, U.M.C. 30
Logan, UT 84322
(801) 750-2682

## VIRGINIA

**UNIVERSITY OF VIRGINIA**
Alderman Lib.—Public Doc.
Charlottesville, VA 22903-2498
(804) 924-3133

## WASHINGTON

**WASHINGTON STATE LIBRARY**
Documents Section
Olympia, WA 98504
(206) 753-4027

## WEST VIRGINIA

**WEST VIRGINIA UNIV. LIB.**
Documents Department
Morgantown, WV 26506-6069
(304) 293-3640

## WISCONSIN

**MILWAUKEE PUBLIC LIBRARY**
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 278-3065

**ST. HIST LIB. OF WISCONSIN**
Government Pub. Section
816 State Street
Madison, WI 53706
(608) 262-4347

## WYOMING

**WYOMING STATE LIBRARY**
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(307) 777-5919

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